Arabic Republic of Egypt
Ministry of Education
Book Sector

Mathematics

For

First preparatory grade

first term

2016
2017

غير مصرح بتداول هذا الكتاب خارج وزارة التربية والتعليم

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Author
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Introduction

It gives us pleasure to introduce this book to our students of the first form preparatory, hoping that it will fulfill what we aimed for in regards of simplicity of the information included and clarity. We hope it helps train our generations to be able to think scientifically and be innovative.

The aspirations of the human have exceeded the limits of Earth and reached out into Outer Space. Every day and night, satellites and information networks report on current events from all over the world.

Due to technological progress, learning sources have become plentiful and various, and learning medias have also become numerous and more various than before. This has also caused teaching aids to become more complex, valuable and of greater impact.

While composing this book, the following was taken into consideration :

- Since studying number has not been enough for solving various life problems, so we must start studying mathematics that uses symbols instead of numbers to solve such problems.
- The use of images, shapes and colors to clarify mathematical concepts and properties of shapes.
- Integrating and linking between mathematics and other subjects.
- Designing educational situations that facilitate the use of active learning strategies and problem - solving skills.
- Display lessons in a way that allows students to deduce and construe information on their own.
- The book includes real-life issues, educational activities and situations related to problems environment, health, population issues in addition to the development of values such as human rights, equality, justice and developing concepts of Patriotism.
- Giving a variety of evaluation exercises at the end of each lesson, a test at the end of each unit and examinations at the end of the book.
- Include Activity models to implement the Overall (Comprehensive) Educational Assessment
- Employ technological methods.

This book has included four units:

Unit 1: Numbers - It aims at presenting the characteristics of numbers, representation of computational processes and understanding the relationships between them.

Unit 2: Algebra - It presents the meaning of algebraic terms and expressions and operations on them.

Unit 3: Geometry and measurement - It focuses on drawing 2 and 3 dimensional (shapes and solids) and being able to identify their properties and analyze the relations between them.

Unit 4: statistics - It aims at acknowledging data collection, organization and presentation as a way of finding a response to certain queries and passing judgement on interpretations and predictions based on the analysis of certain data.

While explaining the topics included in this book, it was taken into consideration that it must be as simple as possible with a wide variety of exercises to provide the students with the opportunity to think and create.

The Author

List of symbols

There is a meaning for each mathematical symbol

Symbol	How read
$X = \{....., ..., ...\}$	X is the set whose elements are
$\varnothing$ or $\{\ \}$	empty set or null set
$\in$	is an element of or belongs to
$\notin$	is not an element of or does not belong to
$\subset$	is a subset of or is contained in
$\not\subset$	is not a subset of or is not contained in
$X \cap Y = \{ a : a \in X \text{ and } a \in Y\}$	Intersection of two sets X and Y is the set which contains all the elements belonging to X and Y.
$X \cup Y = \{ a : a \in X \text{ or } a \in Y\}$	Union of two sets X and Y is that set which contains all the elements belonging to X or Y.
N	Set of Natural numbers { 0, 1, 2, ...}
Z	Integers {..., -2, -1, 0, 1, 2, ...}
Z^+	Set of positive integers { 1, 2, 3, ...}
Z^-	Set of negative Integers { -1, -2, -3, ...}
$\leq$	is less than or equal to
$\geq$	is greater than or equal to

Symbol	How read
$\neq$	is not equal to
$\lvert a \rvert$	absolute value of a
(a, b)	the ordered pair with first coordinate a and second coordinate b.
$a \times a \times \ldots$ to n factors $= a^n$	the n th power for the number a
$\sqrt{a}$	the square root of a
$//$	is parallel to
$\perp$	is perpendicular to
Δ	triangle
$\because$	Since
$\therefore$	Therefore
$\llcorner$	right angle
$\overline{AB}$	Line segment AB
$\overrightarrow{AB}$	ray AB
$\overleftrightarrow{AB}$	Straight line AB
$\angle$	Angle
$\equiv$	is congruent to

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Examinations.

Unit 1

Set of rational numbers

Muhamed Ibn Ahmed Abo Al Rihany Al Bairony

(363 H - 973 AD)

Al Bairony is one of the famous Arab Mathematicians. He stated that letters and digits vary in India by local variation and the Arabs took the best of what they have, then they refined some of them and formed two series known as:

★ Indian numbers

١ , ٢ , ٣ , ٤ , ٥ , ٦ , ٧ , ٨ , ٩ , ٠

and are used by Eastern Arab.

Andalusian numbers (El Ghobaria):

9 , 8 , 7 , 6 , 5 , 4 , 3 , 2 , 1 , 0

and are used in Al Maghreb and Andalus.

Contents

- Revision

Lesson 1 : Set of rational numbers.

Lesson 2 : Comparing and ordering rational numbers.

Lesson 3 : Adding rational numbers.

Lesson 4 : Properties of addition operation in the set of rational numbers.

Lesson 5 : Subtraction of rational numbers.

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Lesson 7 : Properties of multiplication operation in the set of rational numbers.

Lesson 8 : Division of rational numbers.

- Mental Math.
- Miscellaneous Exercises
- unit test.

Lesson 1

Set of rational numbers

We know that

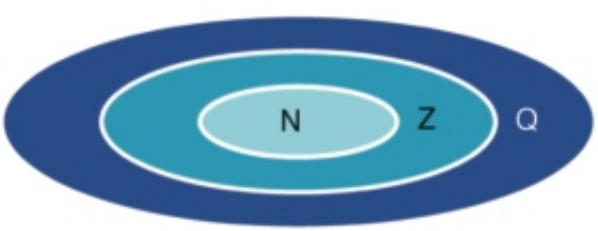
- $2 = \frac{2}{1} \longrightarrow \frac{a}{b}$, $2 \in Z$
- $0 = \frac{0}{1} \longrightarrow \frac{a}{b}$, $0 \in Z$
- $-1 = -\frac{1}{1} \longrightarrow -\frac{a}{b}$, $-1 \in Z$
- $-1\frac{3}{4} = -\frac{7}{4} \longrightarrow -\frac{a}{b}$, $-1\frac{3}{4} \notin Z$
- $-1.25 = -\frac{5}{4} \longrightarrow -\frac{a}{b}$, $-1.25 \notin Z$

A rational number is a number that can be expressed in the form $\frac{a}{b}$, where a and b are integers and $b \neq 0$.

The set of rational numbers

$Q = \{x : x = \frac{a}{b}, a, b \in Z, b \neq 0\}$

The set of Integers Z is a subset of the set of the rational numbers Q. → $Z \subset Q$ Z is a subset of Q



$N \subset Z \subset Q$

The set of rational numbers can be represented on the number line.

The point m is mid way between 0 and 1 represents the rational number $\frac{1}{2}$, and is read as positive half

The point k is mid way between 0 and –1 represents $-\frac{1}{2}$ and is read as "negative half"

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Example (1)

Write the following numbers on the form $\frac{a}{b}$

[a] $|-9\frac{1}{3}|$. [b] 0.15. [c] 40%.

Solution:

[a] $|-9\frac{1}{3}| = 9\frac{1}{3} = \frac{28}{3}$

[b] $0.15 = \frac{15}{100} = \frac{3}{20}$

[c] $40\% = \frac{40}{100} = \frac{4}{10} = \frac{2}{5}$

Example (2)

Write the following numbers on the decimal and percentage form.

[a] $\frac{16}{25}$. [b] $|-2\frac{1}{4}|$. [c] $\frac{25}{8}$.

Solution:

[a] $\frac{16}{25} = \frac{16 \times 4}{25 \times 4} = \frac{64}{100} = 0.64 = 64\%$.

[b] $|-2\frac{1}{4}| = \frac{9}{4} = 2.25 = 225\%$.

[c] $\frac{25}{8} = 3\frac{1}{8} = 3.125 = 312.5\%$.

Different forms of a rational number

- Rational numbers such as $\frac{3}{4}$ and $\frac{7}{5}$ can be written as terminating decimals.

$\frac{3}{4} = 0.75 = 0.750 = ...$ $\qquad$ $\frac{7}{5} = \frac{14}{10} = 1.4 = 1.40 = ...$

- Rational numbers such as $\frac{3}{4}$ and $\frac{7}{5}$ can be written as percentages

$\frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = 75\%$ $\qquad$ $\frac{7}{5} = \frac{7 \times 20}{5 \times 20} = \frac{140}{100} = 140\%$

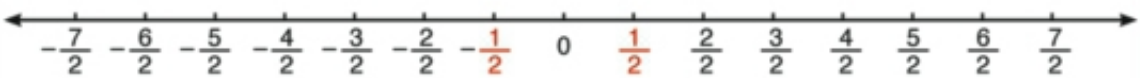
- Rational numbers such as $\frac{1}{3}$ and $\frac{2}{11}$ can be represented by an infinite repeating decimal.

$\frac{1}{3} = 0.333 ... = 0.\dot{3}$ $\qquad$ $\frac{2}{11} = 0.1818 ... = 0.\dot{1}\dot{8}$

The point above the digit means that it is a repeating digit

Exercise (1- 1)

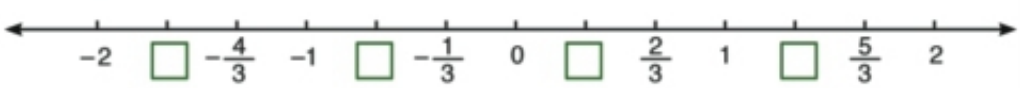
1 **Use the number line to identify the opposite of each rational number in the table**



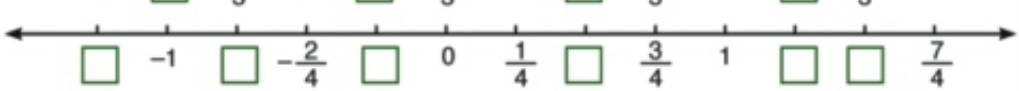
Rational number	$\frac{1}{2}$	$\frac{3}{2}$	$\frac{4}{2}$	$-\frac{5}{2}$	$\frac{7}{2}$	$-\frac{3}{2}$	$-\frac{7}{2}$	$\frac{2}{2}$	$-\frac{6}{2}$	$\frac{6}{2}$
Opposite	$-\frac{1}{2}$									

2 **Complete the rational numbers on the number lines.**

[a]



[b]



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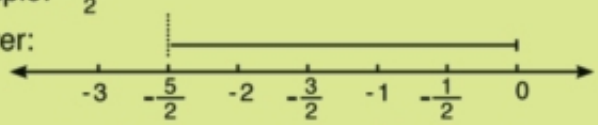
3 **Use an arrow to represent each of the following numbers on the number line.**

Example: $-\frac{5}{2}$

Answer:



[a] $\frac{1}{3}$ [b] $-\frac{1}{3}$ [c] $-\frac{4}{5}$

[d] $-3\frac{1}{2}$ [e] $1\frac{1}{5}$

4 **Classify each statement as true, T, or false, F. when a statement is false, tell why it is false.**

[a] $\frac{1}{3}$ is a natural number. ☐

[b] $-\frac{1}{3}$ is an integer. ☐

[c] $12\frac{5}{6}$ is a rational number. ☐

[d] 6.5 is a rational number. ☐

[e] The number 0 is neither positive nor negative. ☐

[f] The number 0 is a counting number. ☐

5 [a] Why does the definition of a rational number $\frac{a}{b}$ state that $b \neq 0$?

[b] which rational number $\frac{7}{11}$ or $\frac{7}{20}$, can be written as a terminating decimal?

[c] write a decimal for each rational number: 1) $\frac{6}{11}$ 2) $-3\frac{1}{15}$

[d] Evaluate: $|-3\frac{1}{2}|$, $|\frac{5}{8}|$, $|-0.37|$, $|-0.2|$, $|-\frac{1}{3}|$

6 **Write the following numbers in the form $\frac{a}{b}$:**

[a] 0.4 [c] 30% [e] $8\frac{2}{3}$

[b] 0.75 [d] zero [f] - 0.01

7 **Write the following rational numbers as a decimal and a percentage.**

[a] $\frac{1}{6}$ [b] $2\frac{1}{2}$

[c] $7\frac{3}{16}$ [d] $-\frac{3}{20}$

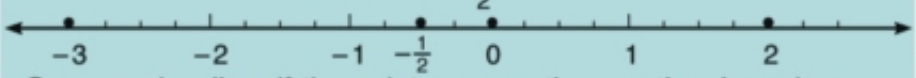
Lesson 2

Comparing and ordering Rational numbers

The number line

$-3 < -2$ $\quad$ $-\frac{1}{2} < 0$ $\quad$ $0 < 2$

$-2 > -3$ $\quad$ $0 > -\frac{1}{2}$ $\quad$ $2 > 0$



On a number line, if the point representing a rational number "a" lies to the left of that representing "b", then

$a < b$ (is less than) or $b > a$ (is greater than)

The ascending order of the rational numbers $-3, 0, 2, -\frac{1}{2}$ is $-3, -\frac{1}{2}, 0, 2$

The descending order of the rational numbers $-3, 0, 2, -\frac{1}{2}$ is $2, 0, -\frac{1}{2}, -3$

Example 1

Represent the rational numbers $3, -\frac{3}{2}, \frac{5}{2}$, 0 and -4 on a number line, then rewrite them in an ascending order.

Solution :

The order is : $-4, -\frac{3}{2}, 0, \frac{5}{2}, 3$

Example 2

Which rational number is greater $\frac{4}{7}$ or $\frac{3}{5}$?

Solution:

The L.C.M. of 7 and 5 is 35

$\frac{4}{7} = \frac{4 \times 5}{7 \times 5} = \frac{20}{35}$

$\frac{3}{5} = \frac{3 \times 7}{5 \times 7} = \frac{21}{35}$

Since $21 > 20$, $\frac{21}{35} > \frac{20}{35}$ then $\frac{3}{5} > \frac{4}{7}$

Example 3

Which rational number is greater $-\frac{2}{3}$ or $-\frac{3}{4}$?

Solution:

The L.C.M. of 3 and 4 is 12

$-\frac{2}{3} = -\frac{2 \times 4}{3 \times 4} = \frac{8}{12}$

$-\frac{3}{4} = -\frac{3 \times 3}{4 \times 3} = -\frac{9}{12}$

since $-\frac{8}{12} > -\frac{9}{12}$, then $-\frac{2}{3} > -\frac{3}{4}$

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Density of rational numbers

Example 4

Find three rational numbers between $\frac{4}{5}$ and $\frac{2}{3}$

Solution :

The L.C.M. for the denominators 5 and 3 equals 15

$$\left.\begin{array}{l} \frac{4}{5} = \frac{4 \times 3}{5 \times 3} = \frac{12}{15} \\ \frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15} \end{array}\right\} \longrightarrow$$

$\frac{11}{15}$ is a rational number existing between the two rational numbers $\frac{4}{5}$ and $\frac{2}{3}$

because $\frac{10}{15} < \frac{11}{15} < \frac{12}{15}$

To find three rational numbers between them, multiply the numerator and denominator of $\frac{12}{15}$ and $\frac{10}{15}$ by 2

$$\left.\begin{array}{l} \frac{12}{15} = \frac{12 \times 2}{15 \times 2} = \frac{24}{30} \\ \frac{10}{15} = \frac{10 \times 2}{15 \times 2} = \frac{20}{30} \end{array}\right\} \longrightarrow$$

The three required numbers are : $\frac{21}{30}$, $\frac{22}{30}$, $\frac{23}{30}$

Because $\frac{20}{30} < \frac{21}{30} < \frac{22}{30} < \frac{23}{30} < \frac{24}{30}$

We can obtain an infinite number of rational numbers between $\frac{4}{5}$ and $\frac{2}{3}$

Deduction

Between any two different rational numbers there exists an infinite number of rational numbers, thus the rational numbers is dense.

Exercise (1- 2)

1 **Write the correct sign (<, = ,>):**

[a] $-\frac{1}{2}$ ☐ 0

[b] $-\frac{3}{4}$ ☐ $\frac{1}{4}$

[c] $-4\frac{1}{2}$ ☐ -5

[d] $4\frac{1}{2}$ ☐ 5

[e] Every positive rational number ☐ 0

[f] Every negative rational number ☐ 0

[g] $|-\frac{3}{2}|$ ☐ $\frac{1}{2}$

[h] $|\frac{15}{2}|$ ☐ $7\frac{1}{2}$

2 **Represent each set of the following rational numbers on the number line, and rewrite its elements in an ascending order.**

[a] $\{0, 1, -2, 3\}$

[b] $\{1\frac{1}{2}, -2\frac{1}{2}, 0, 2\frac{1}{2}\}$

[c] $\{2\frac{1}{2}, \frac{1}{2}, -\frac{1}{4}, 1\}$

[d] $\{-6.5, -4, -5, -3.5\}$

3 **Which of the rational numbers is greater? Explain your answer.**

[a] $\frac{4}{7}$ or $\frac{2}{3}$

[b] $\frac{5}{6}$ or $\frac{4}{5}$

[c] $-\frac{7}{6}$ or $-\frac{11}{15}$

[d] $-\frac{8}{3}$ or $-\frac{16}{7}$

4 **Write the missing rational number.**

[a] $\frac{2}{5} <$ ☐ $< \frac{3}{5}$

[b] $-\frac{2}{3} <$ ☐ $< -\frac{1}{3}$

[c] $\frac{1}{8} <$ ☐ $< \frac{1}{4}$

[d] $-\frac{2}{7} <$ ☐ $< -\frac{3}{14}$

5 **Write the rational number that equals $\frac{3}{5}$, and the sum of its terms is 24**

6 [a] Identify and write four rational numbers between $\frac{3}{2}$ and $\frac{3}{4}$, such that one of them is an integer and the other is a rational number.

[b] Identify and write four rational numbers between $\frac{-4}{9}$ and $\frac{-5}{6}$

Lesson 3

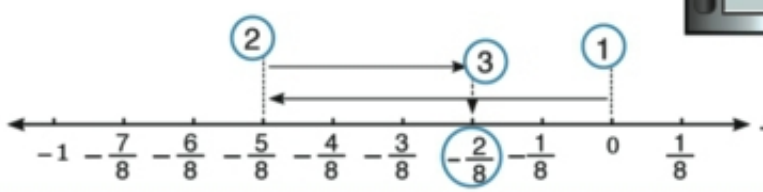
Addition of rational numbers

Represent the rational numbers on the number line will help you to add them.

Example

$-\frac{5}{8}+\frac{3}{8}$

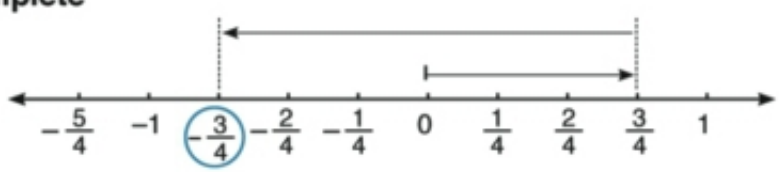
Follow the three steps 1 , 2 , 3 to find the sum



$-\frac{5}{8}+\frac{3}{8}=-\frac{2}{8}$

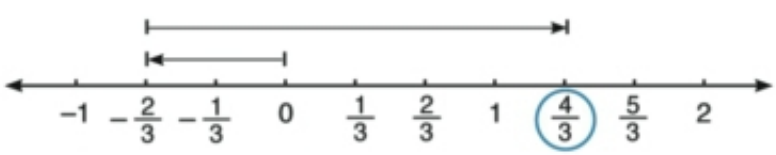
1 Complete

[a]



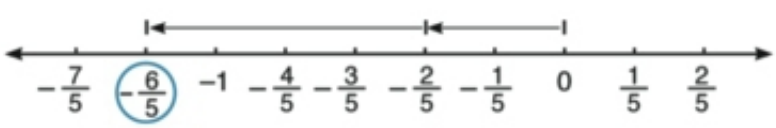
$\frac{3}{4}+(\quad)=\cdots\cdots$

[b]



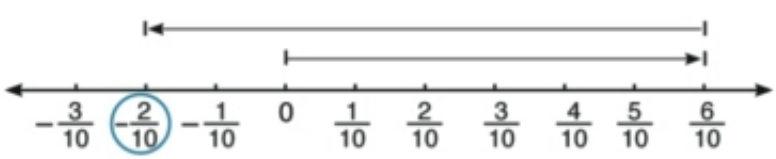
$(\quad)+\cdots\cdots=\cdots\cdots$

[c]



$(\quad)+(\quad)=\cdots\cdots$

[d]



$\cdots\cdots=(\quad)+\cdots\cdots$

2 Use the number line to add the following rational numbers:

a) $\frac{5}{8}+(-\frac{3}{8})$ b) $-\frac{1}{3}+\frac{5}{3}$ c) $-\frac{3}{4}+(-\frac{1}{4})$

Example (2)

Find the value of each of the following in its simplest form:

[a] $-\frac{4}{5}+(-\frac{3}{2})$

[b] $3\frac{1}{4}+(-2\frac{1}{3})$

Solution:

[a] The L. C. M. of 5 and 2 is 10

$$-\frac{4}{5}+(-\frac{3}{2})=-\frac{4\times 2}{5\times 2}+(-\frac{3\times 5}{2\times 5})$$

$$=-\frac{8}{10}+(-\frac{15}{10})$$

$$=-\frac{23}{10}$$

[b] The L. C. M. of 4 and 3 is 12

$$3\frac{1}{4}+(-2\frac{1}{3})=3\frac{1\times 3}{4\times 3}+(-2\frac{1\times 4}{3\times 4})$$

$$=3\frac{3}{12}+(-2\frac{4}{12})$$

$$=2\frac{15}{12}+(-2\frac{4}{12})=\frac{11}{12}$$

Example (3)

Find the value of each of the following in its simplest form:

[a] $1\frac{5}{8}+(-7\frac{3}{4})$

[b] $\frac{1}{5}+(-4\frac{1}{3})$

Solution:

[a] The L.C.M of 8, 4 is 8

$$1\frac{5}{8}+(-7\frac{3}{4})=1\frac{5}{8}+(-7\frac{2\times 3}{2\times 4})$$

$$=1\frac{5}{8}+(-7\frac{6}{8})$$

$$=-6\frac{1}{8}$$

[b] L.C.M of 5 and 3 is 15

$$\frac{1}{5}+(-4\frac{1}{3})=\frac{3\times 1}{3\times 5}+(-4\frac{5\times 1}{3\times 5})$$

$$=\frac{3}{15}+(-4\frac{5}{15})$$

$$=-4\frac{2}{15}$$

Exercise (1- 3)

1 **State whether the result of the sum of the following rational numbers is positive, negative or zero:**

[a] $-\frac{3}{4} + (-\frac{1}{4})$ [b] $\frac{6}{7} + (-\frac{3}{7})$

[c] $\frac{12}{2} + (-\frac{16}{4})$ [d] $\frac{4}{3} + (-\frac{4}{3})$

[e] $-\frac{1}{5} + \frac{3}{5}$ [f] $-\frac{10}{100} + (-\frac{1}{10})$

2 **Find the value and express it in its simplest form:**

[a] $-\frac{3}{10} + (-\frac{2}{5})$ [b] $\frac{1}{4} + \frac{25}{8}$

[c] $\frac{19}{10} + (-\frac{39}{100})$ [d] $-\frac{9}{12} + \frac{3}{16}$

3 **Find the value and express it in its simplest form.**
(Is the sum a rational number?)

[a] $8\frac{2}{3} + (-5\frac{1}{6})$ [b] $-15\frac{1}{2} + 2\frac{3}{8}$

[c] $\frac{1}{4} + 2\frac{3}{8}$ [d] $-8\frac{1}{3} + (-4\frac{1}{12})$

[e] $4 + (-9\frac{5}{8})$ [f] $-2 + 13\frac{3}{7}$

Lesson 4

Properties of addition operation in the set of rational numbers

Complete

[a] $\frac{2}{3} + \frac{3}{4} = ...$ — Is the sum a rational number?

[b] $-\frac{3}{5} + \frac{2}{5} = ...$, $\frac{2}{5} + (-\frac{3}{5}) = ...$ — Are the sums equal in each case?

[c] $(-\frac{5}{3} + \frac{2}{3}) + \frac{1}{3} = (\quad) + \frac{1}{3} = ...$, $-\frac{5}{3} + (\frac{2}{3} + \frac{1}{3}) = -\frac{5}{3} + ... = ...$ — Does addition of rational numbers have the grouping property?

[d] $-\frac{8}{3} + 0 = ...$, $0 + (-\frac{4}{7}) = ...$ — Does the value of a rational number change if you add to it zero?

[e] $\frac{9}{8} + (-\frac{9}{8}) = ...$ — What do you notice?

For every rational numbers $\frac{a}{b}$, $\frac{c}{d}$ and $\frac{e}{f}$ then:

The property	Description in symbols	Example
1- Closure	$\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd} \in Q$	If $\frac{1}{2}, 2 \in Q$ then $\frac{1}{2} + 2 = ... \in Q$
2 - Commutative	$\frac{a}{b} + \frac{c}{d} = \frac{c}{d} + \frac{a}{b}$	
3 - Associative	$(\frac{a}{b} + \frac{c}{d}) + \frac{e}{f} = \frac{a}{b} + (\frac{c}{d} + \frac{e}{f}) = \frac{a}{b} + \frac{c}{d} + \frac{e}{f}$	
4 - Additive–identity	$\frac{a}{b} + 0 = 0 + \frac{a}{b} = \frac{a}{b}$	
5 - Additive–Inverse	For every $\frac{a}{b}$, there exists the additive inverse $-\frac{a}{b}$ Where $\frac{a}{b} + (-\frac{a}{b}) = 0$	

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- If zero is added to any rational number, The Value of This number does not change
- 0 is the additive-identity element in Q
- The additive inverse of zero is itself, the number zero.

Example (1)

Find the value of each of the following, stating the property:

[a] $\frac{5}{10} + (\frac{-7}{10})$, $(\frac{-7}{10}) + \frac{5}{10}$

[b] $(\frac{1}{6} + \frac{3}{8}) + \frac{2}{8}$, $\frac{1}{8} + (\frac{3}{8} + \frac{2}{8})$

[c] $\frac{4}{5} + (\frac{-4}{5})$, $\frac{-5}{12} + \frac{5}{12}$

Solution:

[a] $\frac{5}{10} + (\frac{-7}{10}) = \frac{-2}{10}$

$(\frac{-7}{10}) + \frac{5}{10} = \frac{-2}{10}$

$\therefore \frac{5}{10} + (\frac{-7}{10}) = (\frac{-7}{10}) + \frac{5}{10} + \frac{-2}{10}$ Commutative property

[b] $(\frac{1}{8} + \frac{3}{8}) + \frac{2}{8} = \frac{4}{8} + \frac{2}{8} = \frac{6}{8} = \frac{3}{4}$

$\frac{1}{8} + (\frac{3}{8} + \frac{2}{8}) = \frac{1}{8} + \frac{5}{8} = \frac{6}{8} = \frac{3}{4}$

$\therefore (\frac{1}{8} + \frac{3}{8}) + \frac{2}{8} = \frac{1}{8} + (\frac{3}{8} + \frac{2}{8}) = \frac{3}{4}$ Associative property

[c] $\frac{4}{5} + (\frac{-4}{5}) = \frac{4 - 4}{5} = \text{Zero}$

$\frac{-5}{12} + \frac{5}{12} = \frac{-5 + 5}{12} = \text{Zero}$ Additive inverse property

Exercise (1- 4)

1 **Write the property of addition operation used in each of the following:**

[a] $\frac{7}{2} + \frac{9}{16} = \frac{9}{16} + \frac{7}{2}$

[b] $[\frac{2}{3} + (-\frac{1}{3})] + (-\frac{1}{6}) = \frac{2}{3} + [-\frac{1}{3} + (-\frac{1}{6})]$

[c] $\frac{3}{4} + (-\frac{3}{4}) = 0$

[d] $\frac{5}{8} + 0 = (\frac{5}{8})$

2 **Find the sum of each of the following:**

[a] $\frac{4}{7} + 0$

[b] $0 + (-\frac{7}{10})$

[c] $[\frac{1}{4} + (-\frac{1}{4})] + \frac{3}{4}$

[d] $\frac{5}{6} + (-\frac{3}{6} + \frac{3}{6})$

[e] $[\frac{2}{9} + (-\frac{4}{9})] + (-\frac{3}{9})$

3 **Write the additive inverse of each of the following rational number:**

[a] $\frac{3}{7}$

[b] $-\frac{4}{9}$

[c] zero

[d] -6

[e] -2.3

[f] 5.41

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4 **Complete**

[a] $14\frac{1}{2} + (-11\frac{1}{2}) = \ldots\ldots + [11\frac{1}{2} + (-11\frac{1}{2})]$

[b] $\frac{3}{32} + (-\frac{17}{32}) = [\frac{3}{32} + (-\frac{3}{32})] + \ldots\ldots$

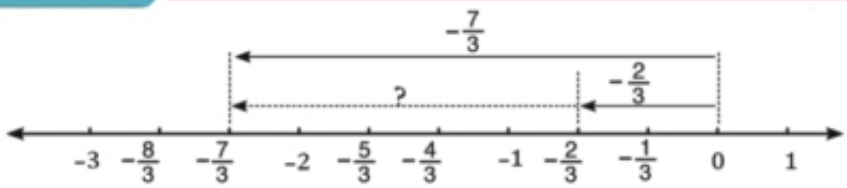
5 **Find the sum in simplest form by using the properties of addition operation in Q:**

[a] $7\frac{1}{4} + (-11\frac{1}{4})$

[b] $\frac{2}{3} + \frac{4}{5} + \frac{3}{4}$

[c] $-13\frac{1}{8} + 7\frac{3}{8}$

Lesson 5 Subtraction of rational numbers



$-\frac{2}{3} + \ldots = -\frac{7}{3}$

$-\frac{2}{3} + (-\frac{5}{3}) = -\frac{7}{3}$

The subtraction operation $(\frac{a}{b} - \frac{c}{d})$ is an addition operation of the minuend $\frac{a}{b}$ with the additive inverse of the subtrahend $\frac{c}{d}$:

$\frac{a}{b} - \frac{c}{d} = \frac{a}{b} + (-\frac{c}{d})$

Example

Calculate the value of each of the following in its simplest form:

[a] $\frac{9}{2} - \frac{13}{4}$

[b] $-3\frac{2}{3} - 2\frac{5}{6}$

Solution:

[a] L.C.M. of 2 and 4 is 4

$\frac{9}{2} - \frac{13}{4} = \frac{9 \times 2}{2 \times 2} + (-\frac{13}{4})$

$= \frac{18}{4} + (-\frac{13}{4})$

$= \frac{5}{4}$

[b] L.C.M. of 3 and 6 is 6

$-3\frac{2}{3} - 2\frac{5}{6} = -3\frac{2 \times 2}{3 \times 2} + (-2\frac{5}{6})$

$= -3\frac{4}{6} + (-2\frac{5}{6})$

$= -5\frac{9}{6} = -5\frac{3}{2} = -6\frac{1}{2}$

Exercise (1- 5)

1 Put ☑ for the correct statement and ☒ for the incorrect one:

[a] $\frac{9}{16} - (-\frac{3}{4}) = \frac{9}{16} + (-\frac{3}{4})$ ☐

[b] $-3\frac{1}{6} - (-7\frac{1}{12}) = -3\frac{1}{6} + 7\frac{1}{12}$ ☐

[c] $0 - (-\frac{13}{5}) = \frac{13}{5}$ ☐

[d] $-\frac{3}{4} - \frac{2}{5} = -\frac{3}{4} + \frac{2}{5}$ ☐

2 Calculate the value of each of the following in its simplest form:

[a] $1\frac{3}{4} - (-2\frac{1}{2})$

[b] $-10\frac{7}{8} - (-4\frac{5}{8})$

[c] $0 - (-\frac{17}{4})$

[d] $6\frac{2}{3} - 3\frac{1}{6}$

[e] $-\frac{3}{5} - \frac{9}{5}$

[f] $-2\frac{1}{2} - 12\frac{1}{16}$

Lesson 6

Multiplying of rational numbers

The product of two rational numbers

To multiply two rational numbers we must multiply their numerators to get the numerator of the product. Then multiply their denominators to get the denominator of the product.

$\frac{2}{5} \times \frac{4}{3} = \frac{2 \times 4}{5 \times 3} = \frac{\cdots}{\cdots}$ $\qquad -\frac{2}{3} \times \frac{6}{7} = -\frac{2 \times 6}{3 \times 7} = \frac{\cdots}{\cdots}$

If $\frac{a}{b}$, $\frac{c}{d}$ are two rational numbers, then $\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}$

If $\frac{a}{b}$, $\frac{c}{b}$ are two rational numbers, then $\frac{a}{b} \times \frac{c}{b} = \frac{a \times c}{b^2}$

Example (1)

Find the result of each of the following

[a] $\frac{2}{5} \times \frac{4}{3}$ $\qquad$ [b] $\frac{3}{7} \times \frac{-4}{5}$

[c] $\frac{-2}{9} \times \frac{-1}{9}$

Solution:

[a] $\frac{2}{5} \times \frac{4}{3} = \frac{2 \times 4}{5 \times 3} = \frac{8}{15}$

[b] $\frac{3}{7} \times \frac{-4}{5} = \frac{3 \times -4}{7 \times 5} = \frac{-12}{35}$

[c] $\frac{-2}{9} \times \frac{-1}{9} = \frac{-2 \times -1}{9 \times 9} = \frac{2}{9^2} = \frac{2}{81}$

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Exercise (1- 6)

1 **Find the value of each of the following:**

[a] $\frac{3}{5} \times \frac{2}{7}$

[b] $-\frac{3}{8} \times (\frac{-5}{3})$

[c] $\frac{4}{5} \times (-\frac{3}{7})$

[d] $-4\frac{2}{7} \times (-5\frac{1}{6})$

[e] $-\frac{2}{3} \times \frac{5}{8}$

[f] $3\frac{1}{8} \times (-4\frac{1}{5})$

2 **Find the value of each of the following:**

[a] $1\frac{1}{2} \times \frac{4}{5}$

[b] $-\frac{3}{4} \times 1\frac{1}{9}$

[c] $\frac{5}{6} \times (-1\frac{1}{15})$

[d] $2\frac{3}{7} \times \frac{7}{17}$

3 **Find the pesul of each of the following:**

[a] $\left|\frac{-3}{7}\right| \times (\frac{-4}{3})$

[b] $\left|-1\frac{1}{2}\right| \times \left|\frac{-5}{3}\right|$

[c] $2\frac{3}{4} \times (-3\frac{1}{5})$

[d] $-4\frac{2}{7} \times (-8\frac{1}{6})$

Lesson 7

Properties of multiplication operation in the set of rational numbers

1 **Multiply:** $\frac{2}{3} \times \frac{3}{4} = \cdots$

Is the product a rational number?

2 **Complete the table:**

● × ▲	▲	●	▲ × ●
.....	$\frac{1}{2}$	$-\frac{3}{5}$	.....
.....	$-\frac{4}{7}$	$-\frac{1}{3}$	.....

Are the products equal if we change the position of the two numbers?

3 **Complete:**

[a] $[-\frac{2}{5} \times (-\frac{3}{4})] \times \frac{1}{3} = -\frac{2}{5} \times (-\frac{3}{4} \times \frac{1}{3}) = -\frac{2}{5} \times (-\frac{3}{4}) \times \frac{1}{3}$

$\frac{\cdots}{20} \times \frac{1}{3}$	$-\frac{2}{5} \times \frac{\cdots}{12}$	$\frac{-2 \times \cdots \times \cdots}{5 \times 4 \times 3}$
$\frac{\cdots}{60}$	$\frac{\cdots}{60}$	$\frac{\cdots}{60}$

Does the multiplication of rational numbers have the grouping property?

[b] $-\frac{3}{5} \times 1 = \cdots\cdots$, $1 \times (-\frac{7}{8}) = \cdots\cdots$

Does the value of the rational number change if you multiply it by one?

[c] $\frac{5}{9} \times \frac{9}{5} = \cdots\cdots$, $-\frac{7}{3} \times (-\frac{3}{7}) = \cdots\cdots$

What do you notice?

[d] $-\frac{1}{2} \times [\frac{3}{7} + (-\frac{2}{7})] = -\frac{1}{2} \times \frac{\cdots}{7} = \frac{\cdots}{14}$

$-\frac{1}{2} \times \frac{3}{7} + ((-\frac{1}{2}) \times \frac{-2}{7}) = -\frac{\cdots}{14} + \frac{\cdots}{14} = \frac{\cdots}{14}$

What do you notice?

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4 Write an example for each of the following properties of multiplication operation in the set of rational numbers

For any three rational numbers $\frac{a}{b}$, $\frac{c}{d}$ and $\frac{e}{f}$ then:

The property	Description in symbols	Example
1- Closure	$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd} \in Q$	If $-\frac{1}{4}$, $-\frac{2}{3} \in Q$ then $-\frac{1}{4} \times (-\frac{2}{3}) = ... \in Q$
2 - Commutative	$\frac{a}{b} \times \frac{c}{d} = \frac{c}{d} \times \frac{a}{b}$	
3 - Associative	$(\frac{a}{b} \times \frac{c}{d}) \times \frac{e}{f} = \frac{a}{b} \times (\frac{c}{d} \times \frac{e}{f})$ $= \frac{a}{b} \times \frac{c}{d} \times \frac{e}{f}$	
4 - Multiplicative–identity	$\frac{a}{b} \times 1 = 1 \times \frac{a}{b} = \frac{a}{b}$	
5 - Multiplicative–inverse	For every rational number $\frac{a}{b}$ 0 , there exists a multiplicative inverse $\frac{b}{a}$ where: $\frac{a}{b} \times \frac{b}{a} = 1$	
6 - Multiplication distributes over addition	$\frac{a}{b} \times (\frac{c}{d} + \frac{e}{f}) =$ $(\frac{a}{b} \times \frac{c}{d}) + (\frac{a}{b} \times \frac{e}{f})$	

- **Multiplying a rational number by 1 does not change its value.**
- **Multiplying a rational number by zero, the product equals zero.**
- **1 is the multiplicative identity element in Q.**
- **There does not exist a multiplicative inverse for the number zero as $\frac{1}{0}$ is meaningless.**

Exercise (1- 7)

1 **State the property of the multiplication of rational numbers used in each of the following statements:**

[a] $-\frac{1}{2} \times \frac{2}{3} = \frac{2}{3} \times (-\frac{1}{2})$

[b] $-\frac{3}{7} \times (-\frac{7}{3}) = 1$

[c] $-\frac{7}{20} \times (\frac{5}{2} \times 4) = (\frac{5}{2} \times 4)(-\frac{7}{20})$

[d] $\frac{5}{4} \times 1 = \frac{5}{4}$

[e] $0.8 \times 0 = 0$

2 **Complete:**

[a] $\frac{2}{3} \times (-\frac{4}{5}) = -\frac{4}{5} \times ....$

[b] $\frac{2}{3}(2 + \frac{1}{2}) = \frac{2}{3} \times 2 + ...$

[c] $\frac{2}{3} \times \frac{3}{2} = ...$

[d] $-\frac{4}{11} \times .... = 1$

[e] The rational number which has no multiplicative inverse is ...

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3 **Find the value of n in each of the following:**

[a] $\frac{5}{7} \times n = \frac{5}{7}$

[b] $-\frac{7}{3} \times n = 0$

[c] $n[\frac{1}{2} + (-\frac{3}{5})] = n \times \frac{1}{2} + 5 \times (-\frac{3}{5})$

[d] $n \times \frac{17}{3} = 1$

[e] $-\frac{7}{3} \times (-\frac{3}{7}) = n$

4 **Use the properties of distribution of multiplication over addition of rational numbers to calculate each value:**

[a] $\frac{4}{9} \times 11 + \frac{4}{9} \times 16$

[b] $\frac{5}{12} \times 3 + \frac{5}{12} \times 9$

[c] $-\frac{3}{7} \times 8 + 5 \times (-\frac{3}{7}) + (-\frac{3}{7})$

[d] $\frac{18}{5} \times \frac{25}{9} + (-\frac{3}{7}) \times \frac{25}{9}$

Division of two rational numbers

To divide the rational number $-\frac{2}{3}$ by $\frac{4}{5}$,

You multiply $-\frac{2}{3}$ by the multiplicative inverse of $\frac{4}{5}$ which is $\frac{5}{4}$

Complete:

$$-\frac{2}{3} \div \frac{4}{5} = -\frac{2}{3} \times \frac{5}{4} = -\frac{\dots}{\dots} = -\frac{\dots}{\dots}$$

If $\frac{a}{b}$ and $\frac{c}{d}$ are rational numbers
$\frac{c}{d} \neq 0$, then
$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$$

Example (1)

Calculate the value of each of the following:

[a] $-\frac{5}{4} \div (-\frac{2}{3})$ [b] $-3\frac{3}{4} \div (-2\frac{1}{4})$

Solution

Since the dividend and divisor are both negative, the quotient is positive.

[a] $-\frac{5}{4} \div (-\frac{2}{3}) = -\frac{5}{4} \times (-\frac{3}{2})$

$= \frac{5 \times 3}{4 \times 2}$

$= \frac{15}{8}$

[b] $-3\frac{3}{4} \div (-2\frac{1}{4})$

$\frac{15}{4} \div \frac{9}{4} = \frac{15}{4} \times \frac{4}{9}$

$= \frac{15}{9} = \frac{5}{3}$

Example (2)

If $a = \frac{3}{4}$, $b = -\frac{5}{2}$, find in simplest form the numerical value of: $\frac{a-b}{a+b}$

Solution:

$$\frac{a-b}{a+b} = \frac{\frac{3}{4} - (-\frac{5}{2})}{\frac{3}{4} + (-\frac{5}{2})} = \frac{\frac{3}{4} + (\frac{5 \times 2}{2 \times 2})}{\frac{3}{4} + (-\frac{5 \times 2}{2 \times 2})} = \frac{\frac{3}{4} + (\frac{10}{4})}{\frac{3}{4} + (-\frac{10}{4})} = \frac{\frac{13}{4}}{-\frac{7}{4}}$$

$$= \frac{13}{4} \times (-\frac{4}{7}) = -\frac{13}{7}$$

Exercise (1-8)

1 **Calculate the value of each of the following, then put the result in its simplest form:**

[a] $\frac{4}{5} \div \frac{3}{7}$

[b] $\frac{8}{3} \div (-\frac{15}{7})$

[c] $-14 \div (-\frac{4}{7})$

[d] $0 \div \frac{3}{5}$

[e] $-\frac{4}{5} \div \frac{7}{2}$

[f] $\frac{3}{8} \div (-7)$

2 **Calculate the value of each of the following, then put the result in its simplest form:**

[a] $-2\frac{1}{5} \div 5\frac{1}{2}$

[b] $-2\frac{3}{4} \div (-3\frac{1}{8})$

[c] $-4\frac{2}{7} \div (1\frac{1}{14})$

[d] $6\frac{1}{4} \div (-15)$

3 **Calculate the value of each of the following, then put the result in its simplest form:**

[a] $(-\frac{18}{5} \div \frac{9}{35}) \times (-\frac{3}{7})$

[b] $(-1\frac{2}{3} \times 4\frac{2}{3}) \div 6\frac{1}{9}$

[c] $-1 \div 2\frac{1}{4}$

[d] $[-\frac{12}{25} \times (-\frac{5}{7})] \div (-\frac{9}{14})$

4 **If $x = \frac{3}{2}$, $y = -\frac{1}{4}$ and $z = -2$, find the simplest form of the numerical value of each of the following:**

[a] $(x + z) \div (y - z)$

[b] $\frac{x + y}{z}$

Example (1)

Find the rational number half way between $\frac{9}{4}$ and $\frac{17}{6}$

Solution:

If the smaller number is $\frac{9}{4}$ and the greater number is $\frac{17}{6}$,

$$\frac{9}{4} + \frac{1}{2}\left(\frac{17}{6} - \frac{9}{4}\right) = \frac{9}{4} + \frac{1}{2}\left[\frac{34}{12} + \left(-\frac{27}{12}\right)\right]$$

$$= \frac{9}{4} + \frac{1}{2} \times \frac{7}{12}$$

$$= \frac{9}{4} + \frac{7}{24} = \frac{54}{24} + \frac{7}{24} = \frac{61}{24}$$ L.C.M of 4 , 24 is 24

Then $\frac{61}{24}$ is a rational number between $\frac{9}{4}$ and $\frac{17}{6}$

Example (2)

Find the rational number that lies one third of the way between $-\frac{5}{6}$ and $-1\frac{1}{2}$ from the smaller.

Solution:

If the smaller number is $-1\frac{1}{2} = -\frac{9}{6}$ and the greater number is $-\frac{5}{6}$,

$$-\frac{9}{6} + \frac{1}{3}\left[-\frac{5}{6} - \left(\frac{-9}{6}\right)\right] = -\frac{9}{6} + \frac{1}{3} \times \frac{4}{6} = -\frac{9}{6} + \frac{4}{18} = -\frac{27}{18} + \frac{4}{18} = -\frac{23}{18}$$

Then $-\frac{23}{18}$ is a rational number that lies one third from $-1\frac{1}{2}$ to $-\frac{5}{6}$

> Is there a rational number that lies one third of the way from $-\frac{5}{6}$ to $-1\frac{1}{2}$? due to the smallest

Exercise (1-9)

1 Choose the correct answer

[a] If $a \times \frac{b}{2} = \frac{a}{2}$, then b = ... [$\frac{a}{2}$, 0 , a , 1]

[b] If $\frac{x}{3} - 4 = 6$, then $\frac{x}{3} + \frac{2}{3}$ = ... [1 , x , $\frac{32}{3}$, 10]

[c] If $4x - y = 11$, $y = 3x$, then x = ... [$\frac{1}{11}$, $\frac{7}{11}$, $\frac{11}{7}$, 11]

[d] If $\frac{x}{y} = 1$, then $2x - 2y$ = ..., [3 , 2 , 1 , 0]

2 Find the rational number in half-way between each of the following

[a] $\frac{3}{8}, \frac{4}{9}$

[b] $\frac{7}{11}, \frac{3}{4}$

[c] $-\frac{11}{9}, -\frac{13}{35}$

[d] $-\frac{37}{160}, -\frac{9}{42}$

[e] $-4\frac{3}{5}, -5\frac{5}{6}$

[f] $-4\frac{3}{7}, 8\frac{1}{3}$

3

[a] Find the rational number that lies one third of the way between $\frac{4}{7}$ and $1\frac{3}{4}$ from the smaller.

[b] Find the number one fourth of the way between $-\frac{1}{9}$ and $-\frac{7}{8}$ from the smallest.

[c] Find the number one fifth of the way between $-\frac{2}{3}$ and $-\frac{3}{5}$ from the smaller.

[d] Find a rational number between $\frac{1}{3}$ and $\frac{3}{4}$

[e] Find a rational number between $-\frac{1}{5}$ and $-\frac{1}{9}$

Miscellaneous Exercises

1 Mark ☑ for the correct statement and ☒ for the incorrect one:

[a] Every integer is a rational number. ☐

[b] Every rational number has a multiplicative inverse ☐

[c] The multiplicative inverse of a rational number is an integer. ☐

[d] Zero is a rational number. ☐

[e] The rational numbers $\frac{12}{16}$, $\frac{15}{20}$ and $\frac{3}{4}$ are represented with the same point on the number line ☐

[f] $2\frac{1}{5}$ is the multiplicative inverse for the rational number $5\frac{1}{4}$ ☐

[g] $\frac{3}{x-3}$ is the additive inverse for the rational number $\frac{3}{3-x}$, where $x \neq 3$ ☐

[h] $(\frac{2}{7} + \frac{3}{5})$ is the multiplicative inverse for the rational number $\frac{35}{31}$ ☐

2 Select the correct value:

[a] If $x + \frac{2}{x} = 5 + \frac{2}{5}$, then x = ... [$\frac{1}{5}$, $\frac{4}{5}$, $\frac{5}{2}$, 5]

[b] If 5a = 45, ab = 1, then b = ... [$\frac{1}{45}$, $\frac{1}{9}$, $\frac{1}{5}$, 9]

[c] If $\frac{x}{y} = \frac{2}{3}$, then $\frac{3x}{2y}$ = ... [$\frac{1}{3}$, 1 , $\frac{3}{2}$, $\frac{9}{4}$]

[d] If 3x = 42, then $\frac{5}{7}$ x = ... [70 , 45 , 30 , 10]

3 Complete in the same pattern:

[a] 6, $5\frac{1}{4}$, $4\frac{1}{2}$, ..., ..., ..., ..., $\frac{3}{4}$

[b] 8, -4, 2, ..., ..., ..., $\frac{1}{8}$

4 If $x = -\frac{1}{3}$, $y = \frac{3}{4}$, z= -3, find the numerical value of each of the following.

[a] x y z

[b] x y + y z

[c] $\frac{xy}{z}$

[d] $\frac{x}{y} - \frac{y}{z}$

Activity (1):

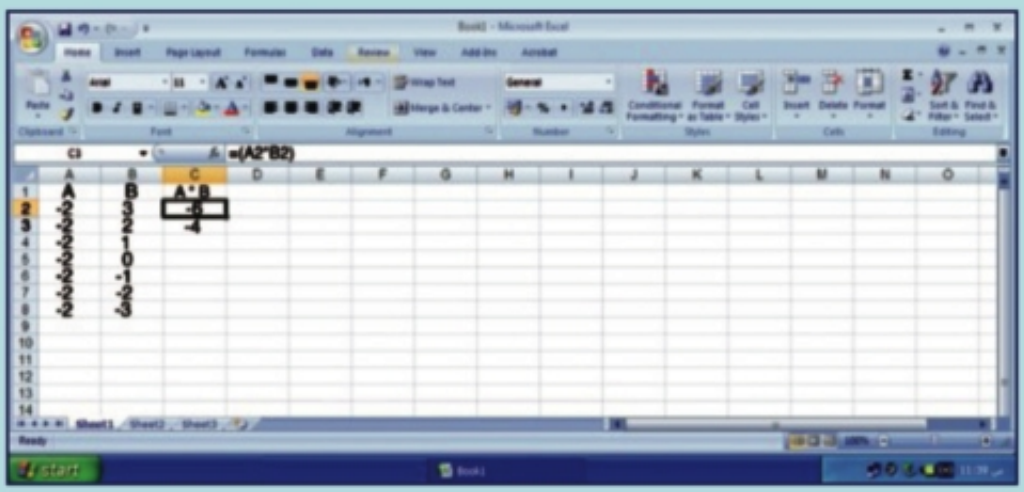
Use the spreadsheet "Excel" to find the product of two integers

Click the start button on the task bar.

from the list of programs ... choose Microsoft Excel

by copying and completing the table

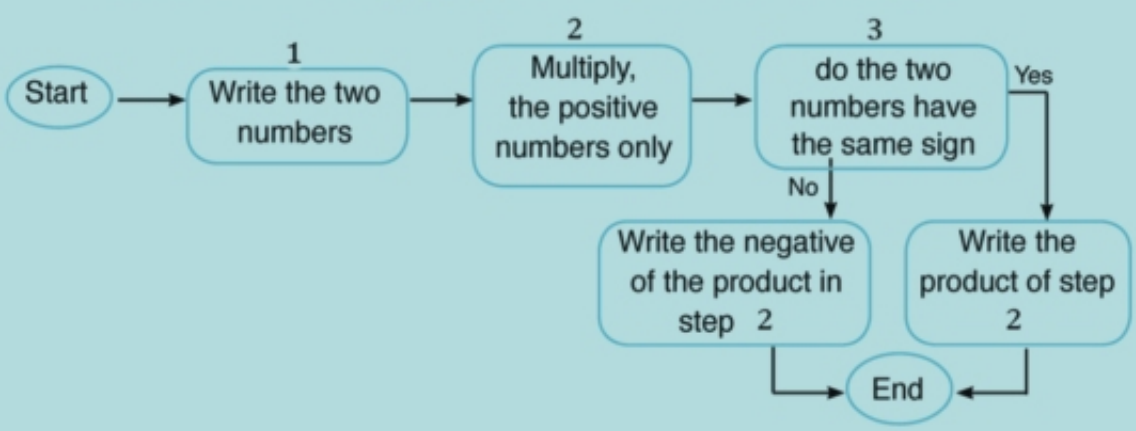
(Hint: Drag the "fill handle")



1 [a] Extend your spreadsheet up to row 15 using other values of a and b.

[b] Save what you have done in your folder

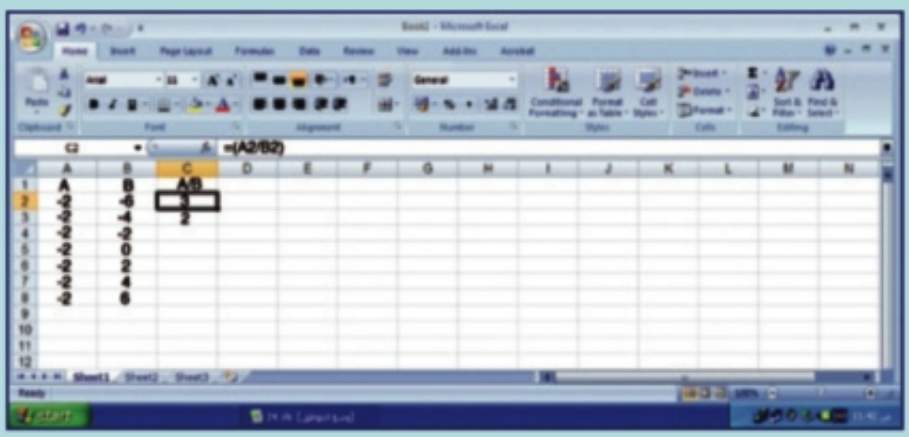
The flow chart below helping you to find the product of two integers.



Activity (2):

Use the spread sheet "Excel" to find the quotient of two integers by copying and completing the table

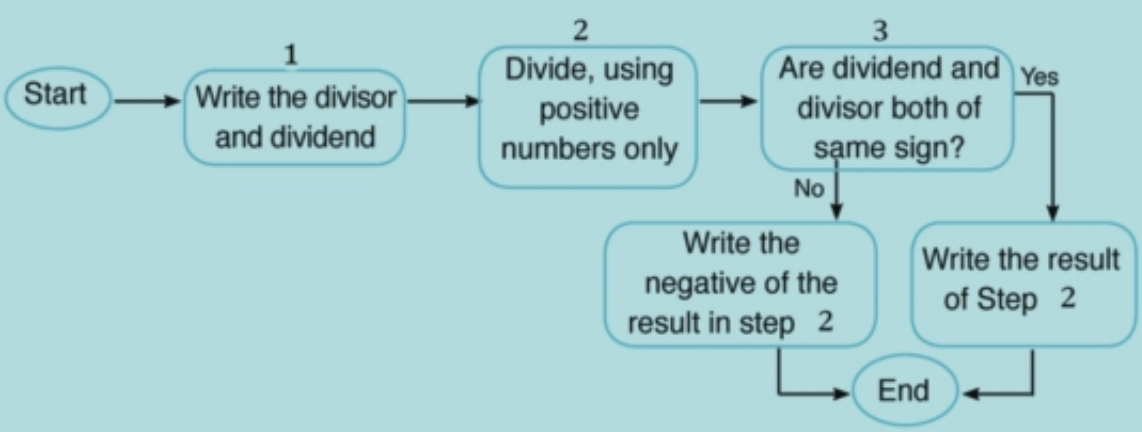
(Hint: Drag the "fill handle")



1 [a] Extend your spreadsheet up to row 15 using other values of a and b.

[b] Save what you have done in your folder

The flow chart below suggests a means of computing the quotient of two integers.



Unit test

1 Complete:

[a] The multiplicative inverse of the rational number $-\frac{2}{3}$ is .....

[b] To find the quotient of dividing $-\frac{7}{12}$ by $-\frac{3}{2}$, we have to multiply ..... by .....

[c] $0 \div (-14) =$ .....

[d] $-\frac{4}{3} \times \left(-\frac{3}{4}\right) =$ .....

[e] The rational number half way between $\frac{3}{5}$, $\frac{4}{5}$ is .....

[f] $\frac{2}{3} \times \left(2 + \frac{1}{2}\right) = \frac{2}{3} \times 2 + \frac{2}{3} \times$ .....

2 Write the rational number n which makes each of the statements true:

[a] $-\frac{3}{5} \times -\frac{5}{3} = n$

[b] $(-3\frac{2}{3}) \times n = -3\frac{2}{3}$

[c] The multiplicative inverse of $1\frac{2}{3}$ is n

[d] $n \times [\frac{3}{4} + (-\frac{2}{3})] = \frac{1}{2} \times \frac{3}{4} + \frac{1}{2} \times (\frac{-2}{3})$

3 Evaluate:

[a] $\frac{3}{4} \times (\frac{1}{2} - \frac{1}{3})$

[b] $\frac{3}{5} \div (-\frac{9}{15})$

[c] $-3\frac{1}{2} \div (-2\frac{1}{4})$

[d] $\frac{7}{12} \times \frac{23}{45} + \frac{17}{12} \times \frac{23}{45} - 2 \times \frac{23}{45}$

[e] $(\frac{1}{2} + \frac{3}{7}) \times [\frac{2}{6} + (-\frac{4}{5})]$

4 [a] If water flows through a pipe at the rate of $2\frac{1}{2}$ litres per minute, how many minutes will it take to fill three 20 litre containers?

[b] How many pieces of wire $3\frac{3}{4}$ metres long can be cut from a wire 60 metres long? Will any wire be left over? If so, how much?

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5 **Put the suitable sign (<, =, >):**

[a] $-3\frac{1}{2}$ ☐ -4

[b] $3\frac{1}{2}$ ☐ 4

[c] $-\frac{7}{3}$ ☐ 0

[d] $|-\frac{13}{2}|$ ☐ $6\frac{1}{2}$

[e] $\frac{392}{9}$ ☐ $44\frac{5}{8}$

[f] $-\frac{214}{14}$ ☐ $-15\frac{2}{3}$

8 [a] If $x = \frac{3}{2}$, $y = -\frac{1}{4}$ and $z = -2$, Find in simplest form the numerical value of each of the following

(1) $x - z \div y$ (2) $\frac{x}{y} - \frac{z}{y}$ (3) $\frac{1}{xyz}$

[b] Find the product of:

$$\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \ldots \times \frac{99}{100}$$

What is the product when the last rational number is $\frac{n-1}{n}$?

Unit 2

Algebra

Muhamed Ibn Moussa Al Khowarezmy

(771 - 849)

Muslim, and Iraqi scientist

Arab are the first to use the word Algebra, the first of them is Al khowarezmy (the father of Algebra), thanks to Al khowarezmy, the world knew the use of the Arab digits which changed our concept of numbers, he also introduced the concept of zero.

Contents

Lesson 1 : Algebraic terms and Algebraic expressions.

Lesson 2 : like terms.

Lesson 3 : Multiplying and dividing Algebraic terms.

Lesson 4 : Adding and subtracting Algebraic expressions.

Lesson 5 : Multiplying a monomial by an Algebraic expression.

Lesson 6 : Multiplying a binomial by an Algebraic expression.

Lesson 7 : Dividing an Algebraic expression by a monomial.

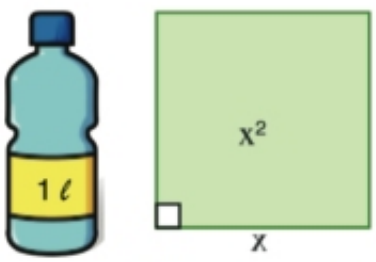
Lesson 8 : Factorization by taking out the H.C.F.

- Miscellaneous Exercises
- Activities unit
- Unit test.

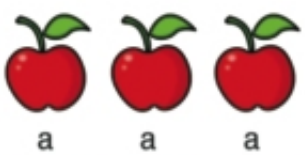
Lesson 1 Algebraic terms and Algebraic expressions

Mathematics is the language of symbols, We use the different symbols to express things or numbers, and we use these symbols by methods similar to that we use with numbers, for example:

- The length of this rectangle is 5 cm.
- The capacity of the bottle is "ℓ" litres.



- If the letter x stands for the length of the side of a square then $x \times x = x^2$ stands for its area.
- If the letter "a" stands for 1 apple, then $a + a + a = 3 \times a = 3a$ stands for 3 apples and is called an algebraic term (monomial).



- If the letter P stands for 1 pound, then -2P stands for losing 2 pounds:

  $(-P) + (-P) = -2 \times P = -2P$, and is called an algebraic term (monomial).

The algebraic term is formed from the product of two or more factors.

The algebraic term $a = 1 \times a$ consists of 2 factors: 1 (numerical), and a (algebraic).

The algebraic term $7x^2 = 7 \times x \times x$ consists of 3 factors:

7 (numerical), x (algebraic), and x (algebraic).

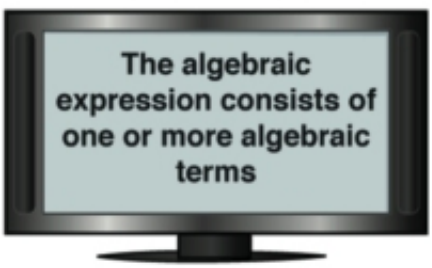
The algebraic term 3a is of first degree because the index of a is 1

The algebraic term $7x^2$ is of second degree because the index of x is 2

If we add the two terms 3a and $7x^2$, then $3a + 7x^2$ is called an algebraic expression

If we subtract 2P from $3a + 7x^2$, then $3a + 7x^2 - 2P$ is an called algebraic expression.

The algebraic expression $4x^3 - x\,y + 5$ is of the third degree because The index of x is the highest degree of the terms forming it.



Exercise (2–1)

1 **Complete:**

Algebraic term	Coefficient	Degree
-7	-7	0
$2ab^2$	2	$1 + 2 = 3$
3	.....	.....
$7ab^3 c$	.....	.....
$-8x^2 b$	.....	.....
$x y^2$	.....	.....

2 **Complete:**

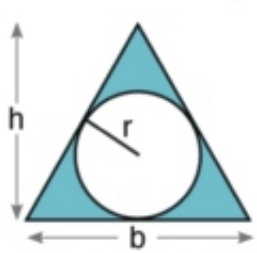
Algebraic expression	Number of terms	Name	Degree
$-3a^5 b$	1	Monomial	6
$3x^2 + y$	2	binomial	2
$5x^3 - 7x + 4$		trinomial	
$2a^2 b + 3ab^2 - a^2 b^2$			
$x^2 y^2 - 3xy^4$			
$a^2 b - 3 ab^3 + 2a^3 b^2 + b^4$			

3 [a] Arrange the terms of the algebraic expression $7ab + 5a^5 b^3 - 3a^2 b^5$ according to the descending order of the indices of a.

[b] Arrange the terms of the algebraic expression $5x + x^2 - 7 + x^3$ according to the ascending order of the indices of x.

4 **In this figure:**

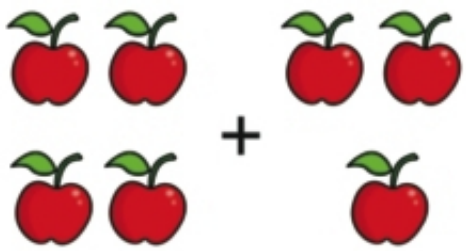
Write the algebraic expression which represents the area of the shaded region then state its degree.



area of circle = πr^2

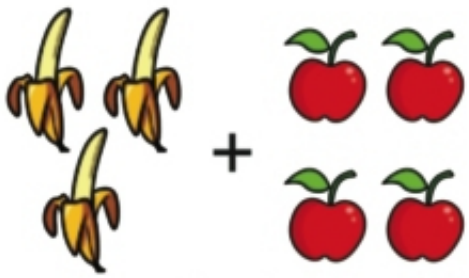
Lesson 2 Like terms

Algebraic terms are similar if the symbols forming its factors are similar and the indices of these symbols are similar.



$4a + 3a = 7a$

The terms 3a and 4a are like terms.



$3b + 4a$

The terms 3b and 4a are unlike terms.

In adding and subtracting like terms, we add and subtract the coefficients of the terms, but the algebraic factors remain as they are.

Example (1)

Simplify: 9a - 4b - 2c - 5a + 7b + 3c

Solution:

The expression $= (9a - 5a) + (-4b + 7b) + (-2c + 3c)$

$= (9 - 5)\,a + (-4 + 7)\,b + (-2 + 3)\,c$

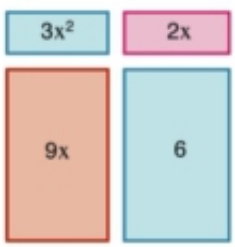
$= 4a + 3b + c$

the expression contains groups of like terms so we use commutative, and distributive properties because unlike terms can not be added

Example (2)

In this figure:

Write the expression which represents areas of the rectangles.



Solution:

The sum of areas $= 3x^2 + 2x + 9x + 6$

$= 3x^2 + (2 + 9)\,x + 6$

$= 3x^2 + 11x + 6$

Exercise (2–2)

1 Complete:

Algebraic terms	Like terms	Unlike terms
$-2x$, $2xy$, x , $-y$	$-2x$, x	
$-ab^2$, $2a^2b$, $3b^2a$, $-ab$		$2a^2b$, $-ab$
x^2y^2 , x^2 , y^2 , $-3x^2y^2$		
$3a^4$, $-4a^3$, a^2 , $-3a^2$		

2 Simplify:

[a] $3x - 5y - x + 2y$

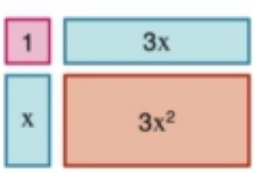
[b] $7a + 6b - 11a + 9b$

[c] $2x - 4y - 9x - 3y$

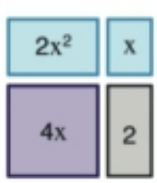
[d] $19m - 4n + 11m - 17n + 9n$

3 Write down the algebraic expressions which represent the areas of the following rectangles:

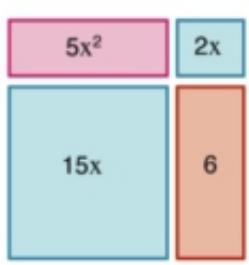
[a]



[b]



[c]



4 Simplify:

[a] $5x - 3x^2 + 4 - 7x^2 - 6x - 1$

[b] $6x^2y - 3xy^2 + 2xy^2 - 5x^2y + 2x^2y^2$

[c] $a^2 + 4a - 5 + 3a^2 - 6a + 1$

[d] $5x^2 - 2x + 8 - 7x - 3 + x^2$

Lesson 3 Multiplying and dividing algebraic terms

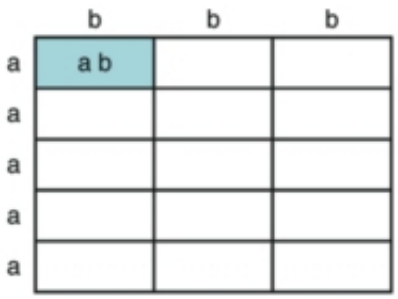
When multiplying the term 5a by the term 3b, we write:

$5a \times 3b = 5 \times a \times 3 \times b$

$= (5 \times 3) \times (a \times b)$

$= 15\ ab$

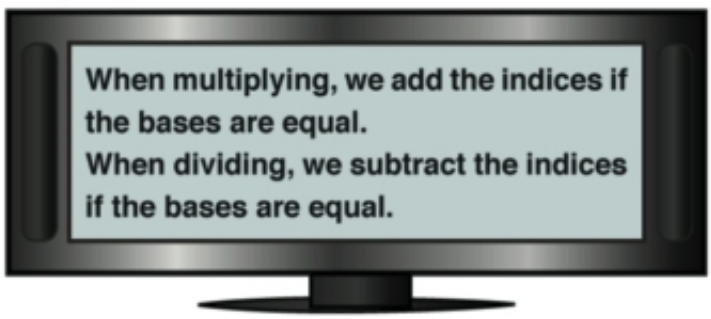
i.e we multiply the coefficients and then the symbols.



When multiplying $5x^2$ by $3x^3$, we write:

$5x^2 \times 3x^3 = (5 \times 3) \times (x^2 \times x^3)$ **What happens when multiplying the like bases?**

$= 15x^{\cdots}$



Complete:

[a] $x^2 \times x^3 = (x \times x) \times (x \times x \times x)$

$= x^{\cdots + \cdots} = x^{\cdots}$

[b] $-2x^6 \times (-5x^2) = (-2 \times -5) \times x^6 \times x^2$

$= 10x^{\cdots}$

[c] $\dfrac{x^5}{x^3} = \dfrac{x \times x \times x \times x \times x}{x \times x \times x}$

$= x^{\cdots - \cdots} = x^{\cdots}$

[d] $\dfrac{-2 \times x^6}{-5 \times x^2} = \dfrac{2}{5}\, x^{\cdots}$

Example (1)

Multiply each of the following

[a] $\frac{1}{2} y^4 \times 2y^2$

[b] $\frac{21}{4} x^5 \times \frac{2}{7} x^3$

[c] $- 3b^6 \times \frac{1}{6} b$

Solution:

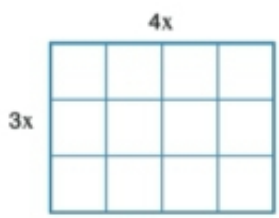
[a] $\frac{1}{2} y^4 \times 2y^2 = y^{4+2} = y^6$

[b] $\frac{21}{4} x^5 \times \frac{2}{7} x^3 = \frac{3}{2} x^{5+3} = \frac{3}{2} x^8$

[c] $-3b^6 \times \frac{1}{6} b = \frac{-3}{6} b^{6+1} = \frac{-1}{2} b^7$

Example (2)

The length of a rectangle is 4x cm and its width is 3x cm, calculate its area.



Solution:

area of the rectangle = length × width

$= 4x \times 3x = 12x^2 \text{ cm}^2$

Example (3)

Divide each of the following

[a] $\frac{4\,a\,b^3}{8\,a\,b}$

[b] $\frac{3\,m^2\,n^4}{27\,m\,n^2}$

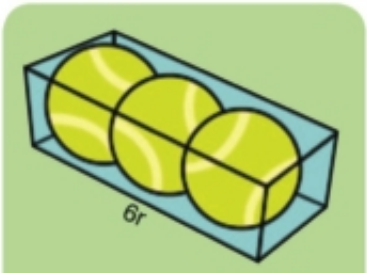
Solution:

[a] $\frac{4\,a\,b^3}{8\,a\,b} = \frac{1}{2} x a^{1-1} \times b^{3-1} = \frac{1}{2} a^0 b^2 = \frac{1}{2} b^2$

[b] $\frac{3\,m^2\,n^4}{27\,m\,n^2} = \frac{1}{9} m^{2-1} \times n^{4-2} = \frac{1}{9} x m \times n^2 = \frac{1}{9} mn^2$

Example (4)

Three tennis balls fit into a box. Calculate the ratio between the volume of the three balls and the volume of the box?



Volume of sphere = $\frac{4}{3}\pi r^3$, $\pi \simeq 3.14$

Solution:

Let "r" be the radius of the ball, The dimensions of the box: 6r, 2r, 2r

Ratio of the space occupied by the balls to the volume. of the box is $\frac{\text{Volume of 3 balls}}{\text{Volume of the box}}$

$$= \frac{3 \times \frac{4}{3}\pi r^3}{6r \times 2r \quad 2r} = \frac{4\pi r^3}{24 r^3} = \frac{\pi}{6}$$

$\simeq 0.52$ The three balls occupy over half the space of the box.

Exercise (2–3)

1 Multiply or divide:

[a] $5x^3y^4 \times 2xy^2$

[b] $5ab^2 \times (-2a^2b)$

[c] $-8y^5 \times (-7y^4)$

[d] $9x^5y^4 \div 6x^3y$

[e] $8m^4n^3 \div (-4mn^2)$

[f] $-32a^3b^6 \div (-4a^3b^2)$

2 Multiply:

[a] $\frac{2}{3}t^4 \times \frac{3}{2}t^4$

[b] $\frac{2}{7}a^2 \times 21a^5$

[c] $\frac{15a^3b}{2} \times \frac{8ab^2}{10}$

[d] $3x^3 \times \frac{1}{6}x^2$

[e] $\frac{4h^3k^3}{7} \times \frac{21hk^5}{2}$

[f] $4m^3 \times \frac{1}{4}m^2 \times (-7m)$

3 Complete:

[a] $36a^5b^8 = 12a^3b^2 \times$ .....

[b] $9a^5 = 3a \times$ .....

[c] $-4c^3d^3 = 2cd^2 \times$ .....

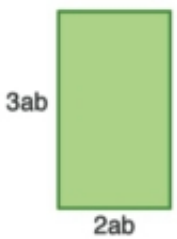
[d] $98a^7b^4 =$ ..... $\times 14a^7b$

[e] $36a^8b^5 = 6ab^2 \times 3a^4b \times$ .....

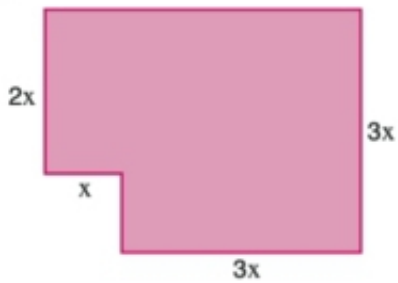
[f] $42x^4y^5 = 3x^2y \times 2xy \times$ .....

5 Calculate the perimeter and the area of each shaded region:

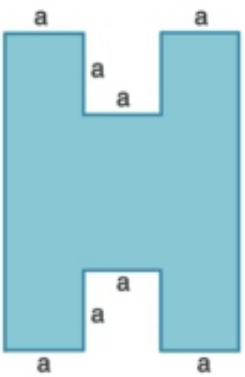
[a]



[b]

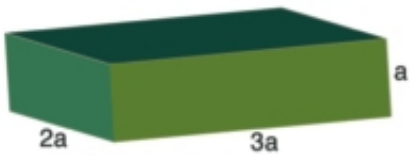


[c]

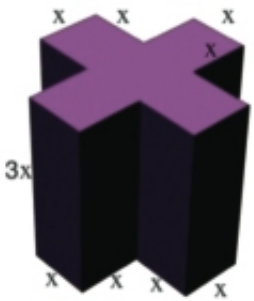


6 Calculate the total surface area and volume of each solid:

[a]



[b]



Lesson 4 Adding and subtracting algebraic expressions

Adding and subtracting algebraic expressions does not differ from adding and subtracting algebraic terms, That is by adding like terms in the expressions each one alone, or subtracting like terms in the expressions each one alone.

Example (1)

Add $2x - 5z + y$ and $7x + 4y - 2z$

Solution

Using the horizontal method

The sum $= 2x - 5z + y + 7x + 4y - 2z$

$= (2x + 7x) + (-5z - 2z) + (y + 4y)$

$= 9x - 7z + 5y$

Using the vertical method

$$\begin{array}{r} 2x - 5z + y \\ \underline{7x - 2z + 4y} \end{array}$$

The sum $= 9x - 7z + 5y$

Example (2)

Subtract $-a^2 - 5ab + 4b^2$ from $3a^2 - 2ab - 2b^2$

Solution:

Using the horizontal method

The remainder $= 3a^2 - 2ab - 2b^2 - (-a^2 - 5ab + 4b^2)$

$= 3a^2 - 2ab - 2b^2 + a^2 + 5ab - 4b^2$

$= (3a^2 + a^2) + (-2ab + 5ab) + (-2b^2 - 4b^2)$

$= 4a^2 + 3ab - 6b^2$

Using the vertical method

Change the signs of the second expression then add

$$\begin{array}{r} 3a^2 - 2ab - 2b^2 \\ \underline{\pm a^2 \pm 5ab \mp 4b^2} \end{array}$$

The remainder $= 4a^2 + 3ab - 6b^2$

Exercise (2–4)

1 **Find the sum of:**

[a] $(3x - 2y + 5)$ and $(x + 2y - 2)$

[b] $(3n^2 + 5n - 6)$ and $(-n^2 - 3n + 3)$

[c] $(3x^2 - 4x - 2)$ and $(-x^2 - 4x + 7)$

[d] $(3a^3 - 2ab^2)$ and $(a^3 - 4ab^2 - b^3)$

2 **Find the sum of each of the following expressions:**

[a]
$$\begin{array}{r} 3x - 4y + 2 \\ -\ 3x + 7y + 3 \\ \hline \end{array}$$

[b]
$$\begin{array}{r} 3a - 7b - 5c + 2 \\ -\ a + 4b + c - 5 \\ 2a \qquad + 3c + 3 \\ \hline \end{array}$$

[c]
$$\begin{array}{r} 5x + 2y - z + 2 \\ 7x + y - 3z + 3 \\ -\ 2x - 5y + 4z - 1 \\ \hline \end{array}$$

3 **Subtract:**

[a] $(x - 2)$ **from** $(2x - 5)$

[b] $(2x + 6y - 7)$ **from** $(2x - 5y + 2)$

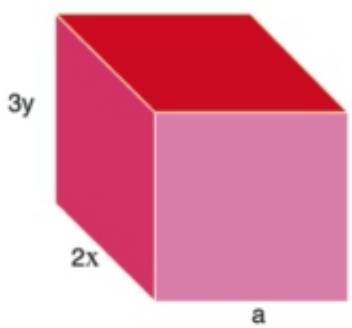
[c] $(a + 2b + 3)$ **from** $(a - 3b + 5)$

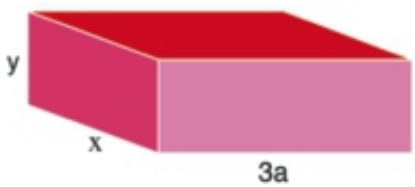
[d] $(-x^2 - 4x + 7)$ **from** $(3x^2 - 4x - 2)$

4 [a] What is the increase of $x^2 - 5x - 1$ **than** $3x^2 + 2 \times -3$

[b] What is the decrease of $2x - 8y - z$ **than the sum of** $3x - 3y + z$, $2x - 4y - 8z$

5 **In the figure below:** Calculate the total surface areas of the two solids.





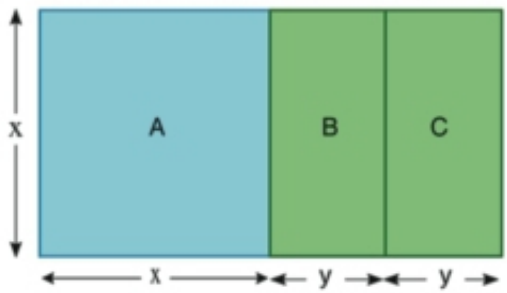
Lesson 5 Multiplying a monomial by an algebraic expression

1 The following figure on the right is a rectangle made up of three parts, A, B, and C

The dimensions of the rectangle are x and (x + 2y) units.

Therefore, the area of the rectangle

= x x (x + 2y) square units.



[a] What is the area of the three parts A, B and C?

Area of A = ... Area of B = ...

Area of C = ... Area of B and C together = ...

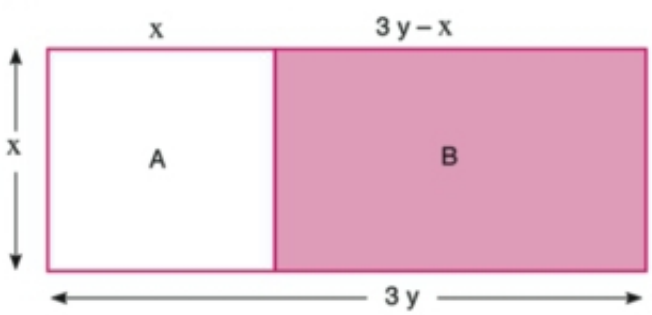
Area of A, B and C = ...

[b] Complete: x (x + 2 y) = ... + ...

$$\begin{array}{r} x + 2y \\ \times\ x \\ \hline \ldots\ldots\ldots \end{array}$$

2 The figure below is a rectangle made up of two parts A and B, the dimensions of the rectangle are x and 3y units.

[a] Area of A and B together = ... , Area of A = ...



[b] Area of B = x (3 y – x)

= .....

$$\begin{array}{r} 3y - x \\ \times\ x \\ \hline \ldots\ldots\ldots \end{array}$$

Example (1)

Multiply

[a] $3(x^2 - 4x)$ [b] $2xy(x^2y + 5y^3)$

Solution:

[a] $3(x^2 - 4x) = 3x^2 - 12x$ [b] $2xy(x^2y + 5y^3) = 2x^3y^2 + 10xy^4$

Example (2)

Simplily: $5(2x-1)-3(x^2-1)+x(5x-1)$, then find the numerical value of the expression when $x=1$

Solution:

$5(2x-1)-3(x^2-1)+x(5x-1)$ $= 10x-5-3x^2+3+5x^2-x$

$= 2x^2+9x-2$

The numerical value $= 2(1)^2+(9 \times 1)-2$ $= 2+9-2=9$

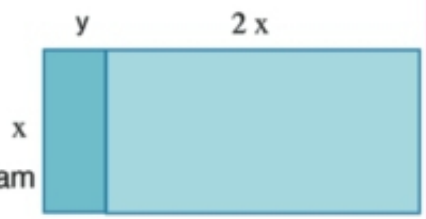
Exercise (2–5)

1 **The opposite figure is a rectangle, its dimensions are x , $y+2x$ It is divided into two smaller regions:**

[a] Calculate the sum of the areas of the two parts.

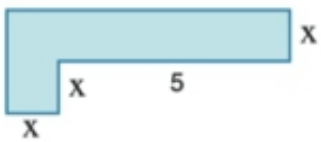
[b] Calculate the product of the length and the width of the rectangular region.

[c] Compare the answers of parts (a), and (b). What are the property of numbers does this diagram illustrate?

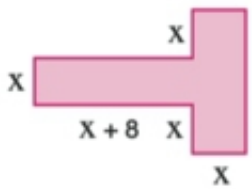


2 **Find the area of each shaded region:**

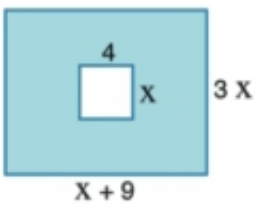
[a]



[b]



[c]



3 **Simplify:**

[a] $4(x-3)$

[b] $3y(y+5)$

[c] $2y^2-y-5$

$\times\ 2y$

.....

[d] $-3(y+3)$

[e] $4(2x-3)$

[f] $2k^2-3k-7$

$\times\ -3k$

.....

[g] $a(a-2)$

[h] $-2c(7-3c)$

4 **Simplify:**

[a] $\frac{1}{3}x^2(6x^2-9xy-3y^2)$

[b] $2x^2y(2x^2-3xy+y^2)$

[c] $\ell m^2(\ell^2-3m\ell-4m^2)$

5 **Simplify:** $3(1-2x)-(x^2-5x+3)+2x(x+3)$, then find the numerical value of the expression when $x=-2$

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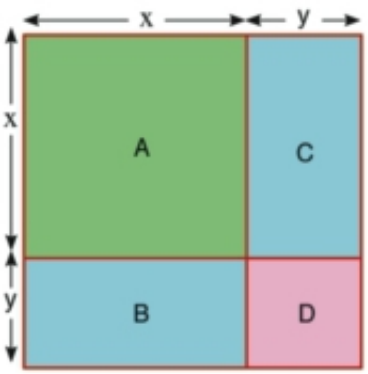
Lesson 6 Multiplying a binomial by an algebraic expression

1 This square is made up of four parts, A, B, C and D



The sides of the square are each $(x + y)$.
therefore the area of the square is
$(x + y)(x + y) = (x + y)^2$ square units.

Complete:

area of A + area D = ... + ...

area of B + area C = ... + ...

area of the square = ...

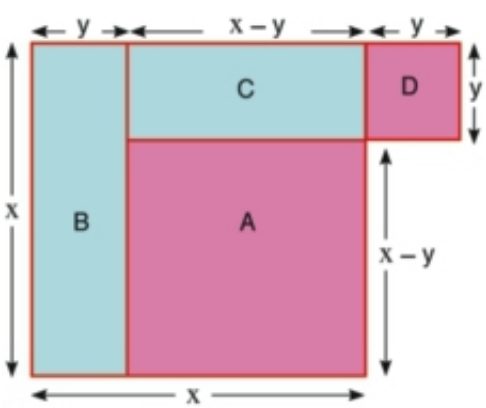
$(x + y)^2$ = ...

Square of a binomial = square of the first monomial + 2 × product of the two monomials + square of the second monomial.

2 This figure is made up of four parts, A, B, C, and D.

Area of the square made up of A, B and C = $x \times x = x^2$ square units.

Therefore, the total area of the figure is $(x^2 + y^2)$ square units.



Complete:

area of A = ...

area of B + area of C = ... + ...

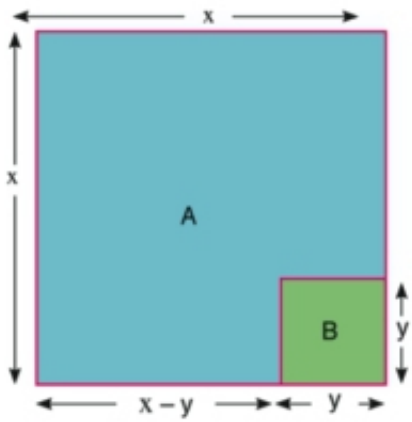
area of B + area of C + area D = ... + ... + ...

$(x - y)^2$ = ...

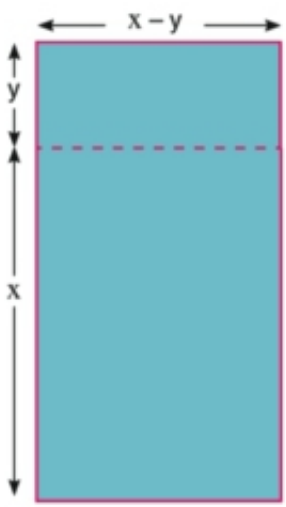
$x^2 + y^2 = (x - y)^2$ + ...

3 **In the opposite figure:**

- A small square B of area y^2 square units is removed from a bigger square A of area x^2 square units, therefore
  The area of the remainder = $x^2 - y^2$ square units.



- Suppose the remaining area is cut into two portions then it is rearranged to form a rectangle, as shown:



Complete:

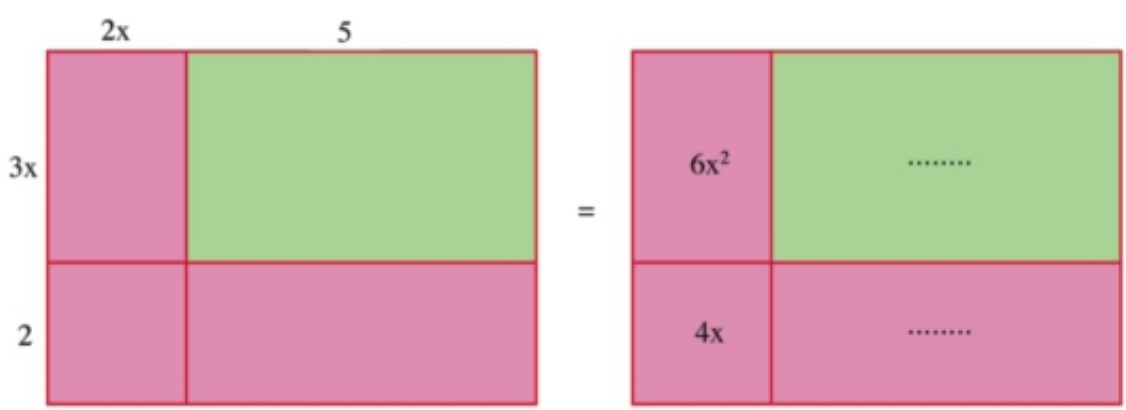
[a] Area of the rectangle = $(x + y)(x - y)$

= .....

[b] $x^2 - y^2$ = ...

4 The following figure shows the product of two binomials $(3x + 2)$, and $(2x + 5)$ can be thought of as the area of a rectangle as shown in the following diagrams:

Complete:



$(3x + 2)\ (2x + 5)$ = ... + ... + ... + ...

= ..... + ... + ...

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Horizontal method

$(3x + 2)(2x + 5) = 3x(2x + 5) + 2(2x + 5)$

$= \ldots\ldots + \ldots\ldots + \ldots\ldots + \ldots\ldots$

$= \ldots\ldots + \ldots\ldots + \ldots\ldots$

Vertical method

$$\begin{array}{r} 3x + 2 \\ 2x + 5 \\ \hline 6x^2 + 4x \\ \ldots\ldots + \ldots\ldots \\ \hline 6x^2 + \ldots\ldots + \ldots\ldots \end{array}$$

Inspection method

$(3x + 2)(2x + 5)$

$= 6x^2 + (\ldots + \ldots) + 10$

$= 6x^2 + \ldots + \ldots$

5 Complete:

[a] $(3x + 2)(x + 7) = 3x^2 + \ldots\ldots + 14$

[b] $(3x - 2)(x - 7) = \ldots\ldots$

[c] $(3x - 2)(x + 7) = \ldots\ldots$

[d] $(3x + 2)(x - 7) = \ldots\ldots$

[e] $(x + 5y)(x - 5y) = \ldots\ldots$

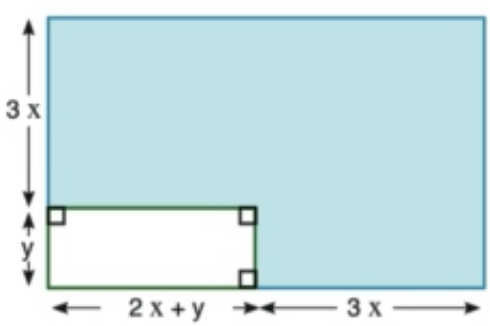
[f] $(x - 4)(x + 4) = \ldots\ldots$

[g] $(2x + y)^2 = \ldots\ldots$

[h] $(2x - y)^2 = \ldots\ldots$

6 In this figure:

What is the area of the shaded part of the rectangle?



Solution:

	Length	Width	Area
Large rectangle	$5x + y$	$3x + y$	$(5x + y)(3x + y)$
Small rectangle	$2x + y$	y	$(2x + y)\,y$

Shaded area = ... − ..... = ...

7 Use the previous methods to find: $(x + y)(2x + y + 1)$

Example (1)

Multiple the following:

[a] $(2x + 3y)^2$

[b] $(5a - b)(5a + b)$

[c] $(m - 7n)^2$

Solution:

[a] $(2x + 3y)^2 = (2x)^2 + 2x \times 3y \times 2 + (3y)^2$

$= 4x^2 + 12xy + 9y^2$

[b] $(5a - b)(5a + b) = (5a)^2 - (b)^2$

$= 25a^2 - b^2$

[c] $(m - 7n)^2 = (m)^2 - m \times 7n \times 2 + (7n)^2$

$= m^2 - 14mn + 49n^2$

Example (2)

Multiply, then find the numerical value at $x = 2$, $y = 1$

[a] $(x + 9)(x + 2)$

[b] $(y + 3)(y + 1)$

[c] $(2x + y)(x + 2y)$

Solution:

[a] $(x + 9)(x + 2) = x^2 + 11x + 18$ at $x = 2$

$= (2)^2 + 11 \times 2 + 18 = 4 + 22 + 18 = 44$

[b] $(y + 3)(y + 1) = y^2 + 4y + 3$ at $y = 1$

$= (1)^2 + 4 \times 1 + 3 = 8$

[c] $(2x + y)(x + 2y) = 2x^2 + 5 \times y + 2y^2$ at $x = 2$

$= 2 \times (2)^2 + 5 \times 2 \times 1 + 2 \times (1)^2$

$= 8 + 10 + 2 = 20$

Exercise (2–6)

1 Simplify Multiply the following:

[a] $(4x + 1)(2x + 3)$

[b] $(5m - 2)(6m + 1)$

[c] $(8x - 2)(3x - 7)$

[d] $(4m - 7)^2$

[e] $(3x + y)^2$

[f] $(4m - 7)(4m + 7)$

[g] $(6x - 2y)(6x + 2y)$

[h] $(-12m + 9)(-12m - 9)$

2 Simplify:

[a] $3(m - 5)(m + 2)$

[b] $3a(2a - 5b)(3a + b)$

[c] $3x(2x + 4y)^2$

[d] $4(xy - 2)^2$

[e] $(5x - 2y)^2 - (5x + 2y)^2$

[f] $(2x^2 + 3)(x^2 - 5) - (3x^2 + 2)^2$

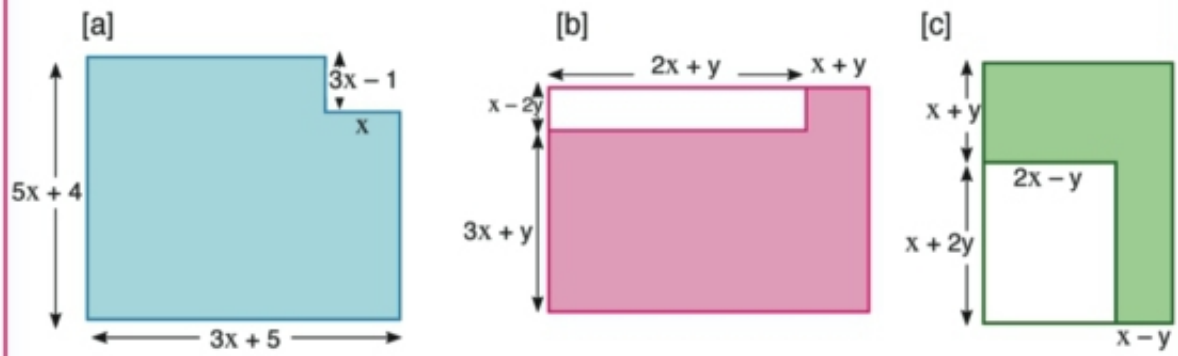
3 Select the correct value:

[a] If $(2x + y)^2 = 4x^2 + kxy + y^2$, then k= ..... [2, 4, 8]

[b] If $(x - y)(2x + y) = 2x^2 + kxy - y^2$, then k = ... [–1, 1, 3]

[c] If $(x - 3)(x + 3) = x^2 + k$, then k = ... [9, 6, -9]

4 **Write an expression for the perimeter and area of each shaded region:**



5 **Multiply then calculate the numerical value of the product by substitution When $x = 1$, $y = -2$:**

[a] $(2y + 7)(3y + 4)$

[b] $(3x + y)(x + 3y)$

[c] $(x + 4)(3x + 2)$

[d] $(x + 4)^2 (3y + 2)$

6 **Simplify:**

[a] $(2y + 1)(y^2 + y + 5)$

[b] $(4 + 2a + 3a^2)(2 - a)$

[c] $(7n + 2)(2n^2 - 5n + 1)$

[d]
$$\begin{array}{r} 4x^2 + x - 5 \\ \times \quad x + 6 \\ \hline \ldots\ldots\ldots\ldots \end{array}$$

7 [a] If $(2 - y)^3 = 8 - 12y + 6y^2 - y^3$ obtain the value of $(2 - y)^4$

[b] Use **Mental Math** to find the value of:

1) $(41)^2$ in the form $(40 + 1)^2$

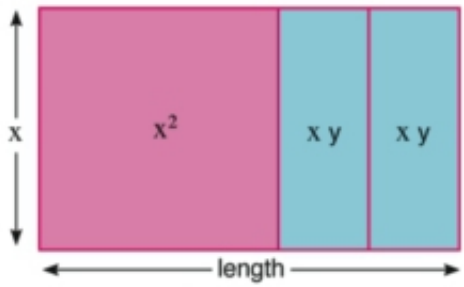
2) $(49)^2$ in the form $(50 - 1)^2$

3) 201×199 in the form $(200 + 1)(200 - 1)$

Lesson 7 Dividing an algebraic expression by a monomial

This figure is a rectangle made up of three parts.

Area of the rectangle = $(x^2 + 2xy)$



The length of the rectangle =
Area of the rectangle ÷ Width of the rectangle

The length of the rectangle = $\frac{x^2 + 2xy}{x} = \frac{x^2}{x} + \frac{2xy}{x}$ = ... + ...

1 **Complete:**

[a] The length of the rectangle whose area $x^2 + xy = \frac{x^2 + xy}{.....}$ = ... + ...

[b] The length of the rectangle whose area $2xy = \frac{2xy}{.....}$ = ...

[c] The length of the rectangle whose area $xy = \frac{xy}{.....}$ = ...

[d] The length of the square whose area $x^2 = \frac{x^2}{.....}$ = ...

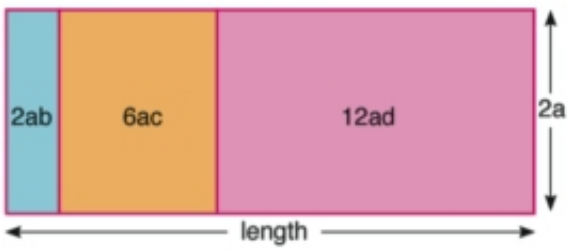
2 The following figure is a rectangle made up of three parts, its area is (2ab + 6ac + 12ad)

Length of the rectangle = area ÷ width

$= \frac{..... + ... + ...}{2a}$

$= \frac{.....}{2a} + \frac{.....}{2a} + \frac{.....}{2a}$

= ..... + ... + ...



Example

Divide each of the following

[a] $\frac{26\,e^2 + 14e^4}{2\,e}$ [b] $\frac{9\ell^3 m^4 - 18\ell m^4}{3\,\ell\, m^2}$

Solution:

[a] $\frac{26\,e^2 + 14\,e^4}{2\,e} = \frac{26e^2}{2\,e} + \frac{14e^4}{2\,e} = 13\,e + 7\,e^3$

[b] $\frac{9\,\ell^3 m^4 - 18\,\ell\, m^4}{3\,\ell\, m^2} = 3\,\ell^2 m^2 - 6m^2$

Exercise (2–7)

The symbols in the following monomials and algebraic expressions represent non - zero numbers.

1 Complete:

[a] $\frac{18a^5 b^2}{6a^2} = \frac{18}{6} \times \frac{a^5}{a^2} \times \frac{b^2}{1} = ...$

[b] $\frac{15n^3 - 9m^4 n^2}{-3n^2} = \frac{15n^3}{-3n^2} + \frac{-9m^4 n^2}{-3n^2} = ... + ...$

[c] $\frac{12x^3 - 8x}{4x} = \frac{12x^3}{4x} - \frac{8x}{4x} = ... - .....$

[d] $\frac{16x^4 y^2 - 12x^3 y^3 + 24x^2 y^4}{8x^2 y} = \frac{16x^4 y^2}{8x^2 y} - \frac{.....}{8x^2 y} + \frac{.....}{8x^2 y} = ... - ..... + ...$

2 Find the quotient in each case:

[a] $\frac{18a^2}{3a}$

[b] $\frac{18m^4 + 32m^2}{-2m^2}$

[c] $\frac{48x^3 - 80x^2}{8x^2}$

[d] $\frac{18x^4 y^5 - 42x^5 y^4}{-6x^2 y^2}$

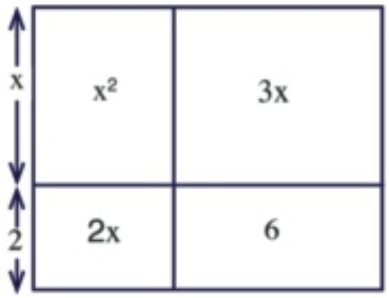
[e] $\frac{24x^4 - 18x^3 - 42x^2}{6x^2}$

[f] $\frac{32x^5 - 48x^3 + 72x^7}{-8x^3}$

Lesson 8 Dividing an algebraic expression by another one

In the opposite figure:

A model of peice of land rectngular shape its area $(x^2 + 5x + 6)$ m^2 and its width is $(x + 2)$ m, find its length to get the length of the rectangle you have to find the quotient of $x^2 + 5x + 6$ by $x + 2$



Solution:

[a] Rearrang the dividend $(x^2 + 5x + 6)$ and the divisor $(x + 2)$ according to the desendingly powers of x.

[b] Divide x^2 by x the result x

[c] Multiply x by the divisor

[d] Subtract $x^2 + 2x$ from $x2 + 5x + 6$ to get

[e] Repeat the steps 2, 3, 4 to be

the final subtraction equals zero

$$
\begin{array}{r|l}
x^2 + 5x + 6 & x + 2 \\
\cline{2-2}
{}^{-}x^2 \mp {}^{-}2x & x + 3 \\
\cline{1-1}
3x + 6 & \\
{}^{-}3x \mp 6 & \\
\cline{1-1}
0 \quad 0 &
\end{array}
$$

$\therefore$ The quotient = $x + 3$ the length of the rectangle

Example (1)

Find the quotient of $x^3 + 1$ by $x + 1$

Solution:

$$
\begin{array}{r|l}
x^3 + \qquad +1 & x + 1 \\
\cline{2-2}
{}^{-}x^3 \mp x^2 & x^2 - x + 1 \\
\cline{1-1}
-x^2 \qquad +1 & \\
\mp x^2 \pm x & \\
\cline{1-1}
x + 1 & \\
-x \mp 1 & \\
\cline{1-1}
0 \quad 0 &
\end{array}
$$

$\therefore$ The quotient = $x^2 - x + 1$

Example (1)

Find the value of k which makes the expression

$2x^3 - x^2 - 5x + k$ is divisible by $2x - 3$

Solution:

$$
\begin{array}{r|l}
2x^3 - x^2 - 5x + k & 2x - 3 \\ \hline
{}^{-}2x^3 \pm 3x^2 & x^2 + x - 1 \\ \hline
2x^2 - 5x + k & \\
{}^{-}2x^2 \pm 3x & \\ \hline
-2x + k & \\
\pm 2x \mp 3 &
\end{array}
$$

$\therefore k - 3 = 0 \longrightarrow k = 3$

Exercise (2-8)

1 Find the quotient of each of the following:

[a] $2x^2 + 13x + 15$ by $x + 5$

[b] $3x^3 - 4x + 1$ by $x - 1$

[c] $3x^2 + x^3 - x - 3$ by $x^2 - 1$

[d] $x^4 + 3x^2 + 2$ by $x^2 + 1$

[e] $x^4 + 49 - 18x^2$ by $2x - 7 + x^2$

[f] $x^3 - 27$ by $x - 3$

2 Find the value of k which makes the expression

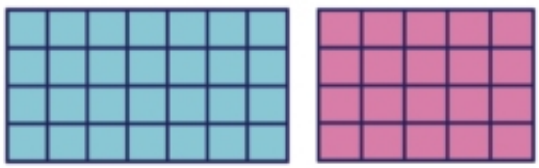
[a] $x^3 - 3x^2 - 25x + k$ is divisible by $x^2 + 4x + 3$

[b] If the area of rectangle is $(2x^2 + 7x - 15)$ and its length is $(x + 15)$. Find its width and its perimeter at $x = 3$cm

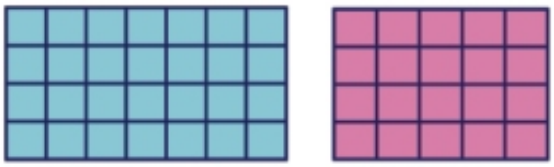
Lesson 9 Factorization by Identifying the highest common factor (H.C.F.)

Draw a rectangle whose dimensions are 7, 4 units on a squared paper, and a rectangle whose dimensions are 5, 4 of the same units.

Calculate the area of the two rectangles by two different methods.



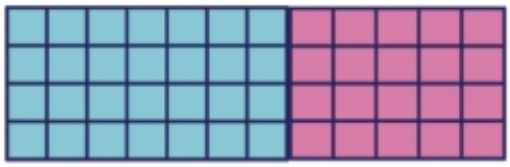
First method



Area of rectangles = (4 x 7) + (4 x 5)

= ..... + ... = ...

Second method



Area of rectangles = 4 x (7 + 5)

= 4 x ..... = ...

Note that

4 x (7 + 5) = (4 x 7) + (4 x 5) means that we used distributing multiplication on addition, while (4 x 7) + (4 x 5) = 4 x (7 + 5) means factorization by identifying the H.C.F. between the two terms (4 x 7) and (4 x 5), which is 4. Each of 4, (7 + 5) is called a factor of the expression 4 (7 + 5)

Generally: a b + a c = a (b + c)

Example (1)

Factorize by identifying the H.C.F. of the expression:

$3x^2 y^3 - 9x^3 y^4 + 12x^3 y^2$

Solution

The H.C.F. = $3x^2 y^2$

To find the other factor, we divide each term by the H.C.F.

$3x^2 y^3 - 9x^3 y^4 + 12x^3 y^2$

$= 3x^2 y^2 (y - 3x y^2 + 4x)$

Example (2)

Factorize by identifying the H.C.F. of the expression:

3a (4a + 5b) – 2b (4a + 5b)

Solution

The H.C.F. = (4a + 5b)

3a (4a + 5b) – 2b (4a + 5b)

= (4a + 5b) (3a – 2b)

Exercise (2-9)

1 **Factorize by identifying the H.C.F.:**

[a] $3x^2 + 6x$

[b] $8y^2 - 4x^2$

[c] $5y - 10$

[d] $35a + 10a^2$

[e] $49b^2 - 7b^3$

[f] $3x^2 + 12x - 6$

2 **Factorize by identifying the H.C.F.:**

[a] $12a^2 b + 18a^3 b^2$

[b] $9m^4 n^2 - 6m^3 n^3 + 12m^2 n^4$

[c] $18a^2 bc - 6abc + 30abc^2 - 24ab^2 c^2$

[d] $-2x^5 + 4x^2 - 6x + 2x^3$

[e] $3x (a+b) + 7 (a + b)$

[f] $(x + 4) x^2 + (x + 4) y^2$

[g] $3x^2 (x - 7) + 2x (x - 7) + 5 (x - 7)$

[h] $4m^2 (2x + y) - 3m (2x + y) - 7 (2x + y)$

3 **Find the result by identifying the H.C.F.:**

[a] $7 \times 123 + 7 \times 35 - 7 \times 18$

[b] $6 \times 15^2 + 18 \times 15 - 8 \times 15$

Miscellaneous Exercises

1 Circle the correct answer:

[a] If a = 0, b = 5, and c = 2 , then the numerical value of $a^2 b + ac$ equals.....

[0, 2, 6, 8]

[b] If the price of 4 shirts is L.E X, then the price of 40 shirts is .....

[$10x, \frac{x}{40}, \frac{5x}{2}, \frac{40}{4}$]

[c] If $\frac{a}{b} = 70$, then $\frac{a}{2b} =$ .....

[35, 68, 72, 140]

[d] $7x^2 + 14y^2 = 7$ (.....)

[$x^2 + y^2, x^2 + 2y^2, 7x^2 + y^2, x + 2y$]

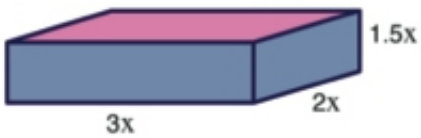
[e] $(15x^4 + 5x^3) \div 5x^3 =$ .....

[$3x^2 + x, 5x^2 + 1, 3x + 1, 4x^4$]

[f] $\frac{3x}{7} - \frac{x}{7} =$ .....

[$\frac{2}{7}, \frac{x}{7}, \frac{2x}{7}, 2x$]

[g] The volume of the cuboid is .....



[$6.5x, 2(5x)(1.5x), 9x^3, 2(4.5x^3)$]

[h] If x = 4 , y = 6 , and z = 24, which of the following is true?

[$x = \frac{z}{y}, x = \frac{y}{z}, x = yz, x = y + z$]

2 Complete:

[a] The degree of the term $3x^2 y$ is ..... and its coefficient is .....

[b] $6a^2 + 12ab = 3a$ (..... + ...)

[c] $x(a + 1) - y(a + 1) = (a + 1)$ (.....)

[d] $(4a^2 + 2a) \div 2a =$ .....

[e] $7 + 7^2 + 8 + 8^2 =$ ..... x 8 + ... x 9

[f] $(31)^2 = 901 + 2 \times$ ..... x .....

[g] $(20 + 1)(20 - 1) = 400 -$ .....

[h] The seventh term in the pattern: $\frac{1}{10000}, \frac{1}{1000}, \frac{1}{100}$, ..., ... is .....

3 Simplify to simpliest form:

[a] $4a + 9b + 5a - 2b + 6b - 3a$

[b] $3x^2 + 5x^3 + x^2 + 2x^3$

[c] $2x^3 y^2 \times 4x^2 y^3$

[d] $2x(3x + y) + 3y(x + y)$

4 Use two methods to simplify:

[a] $\dfrac{x^3 + xb^2}{xb}$

[b] $\dfrac{19^2 - 2 \times 19 + 19}{19}$

5 Write the product:

[a] $(2x - 5y)(2x + 5y)$

[b] $(2x - 5y)(2x - 5y)$

[c] $(x + 1)(x^2 - x + 1)$

[d] $(x - 3y)^2$

[e] $(2x - y)^2$

[f] $(3a - 5b)(2a + 7b)$

6 Factorize by identifying the H. C. F.:

[a] $16x^3 + 8x^2$

[b] $15a^3 b^4 + 6a^5 b^3 - 3a^2 b^2$

[c] $15 \times 17 + 15 \times 13 - 15 \times 30$

[d] $5(48)^2 + 7 \times 48 + 53 \times 48$

7

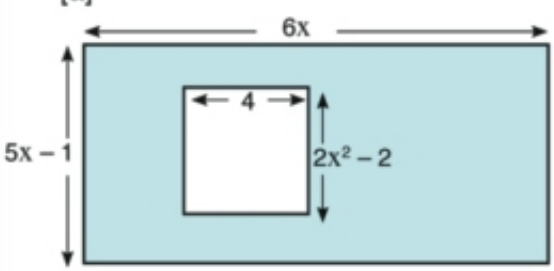
[a] By what expression is $3x^2 - 5 + 2x$ increased from the sum of

$x + 5x^2 + 1$ and $2x^2 - 4 - 2x$

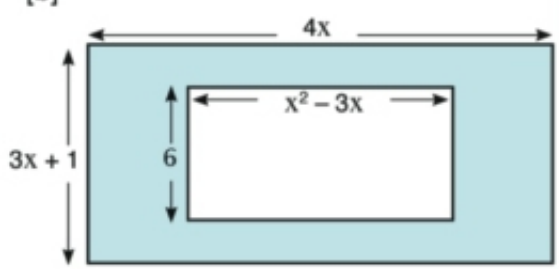
[b] Simplify: $2n(n + 5) + n(6 - n)$, then calculate the numerical value when $n = -1$

8 Find the area of the shaded region:

[a]



[b]



9 [a] If $a = 4x - 3$, $b = 2x + 1$, and $c = 3x - 2$. Find in terms of x the value of the expression: $ab - c^2$

[b] Multiply: $(x - 2y)(x + 2y)$ by $(x^2 + 4y^2)$

10 **Complete:**

[a] $5x^2 + 3$ is an algebraic expression of the ..... degree.

[b] $(2x - 1)^2 = ... - 4x + 1$

[c] $a^2 b + b^2 a = ... (a + b)$

[d] $(x - 5)(.....) = x^2 - 25$

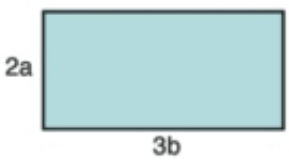
11 **Circle the correct value:**

[a] The Algebraic term $2x^3$ has ..... factors. [2, 3, 4, 5

[b] $4x^2 y^2 - 2xy^2 + 4x^2 y = ... (2xy - y + 2x)$ [4xy , 2xy , 2x , 2y]

[c] If 2b is the length of a cube then its volume equals ..... [$4b^2$, $2b^3$, $4b^3$, $8b^3$]

[d] This figure is a rectangle with dimensions 2a, 3b then its perimeter is .....[6 ab , 2a + 3b , 4a + 6b , $(2a + 3b)^2$]



[e] The factorization of $6x^2 y - 4x$ by identifying the H.C.F. is .....

[$3xy(x + y)$, $2xy(3y - 2)$, $2xy(3x - 2)$, $2x(3xy - 2)$]

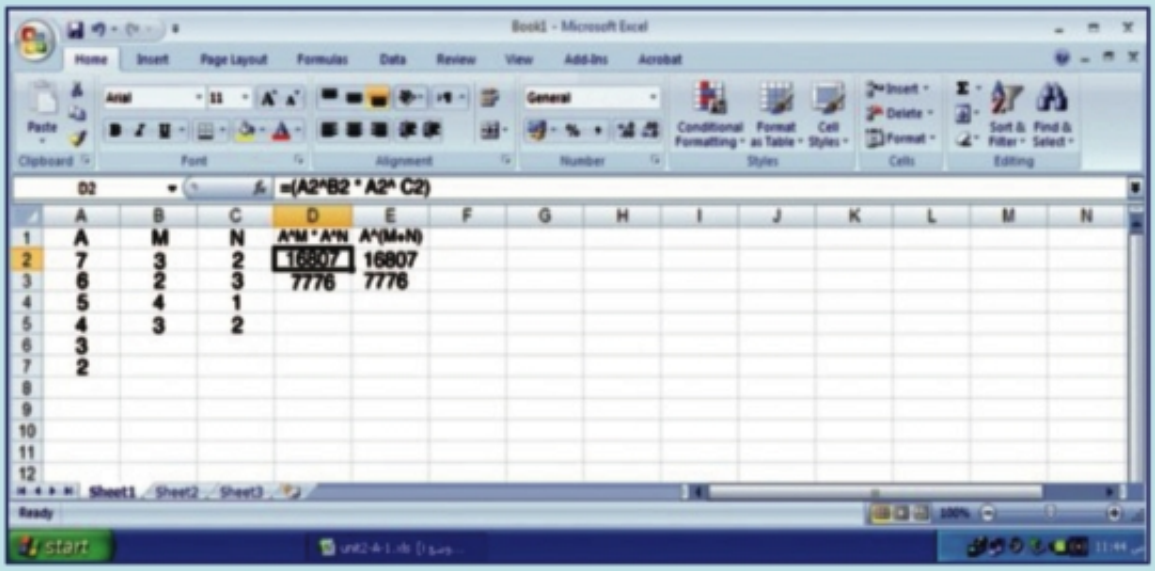
12 **Find the quotient of each of the following:**

[a] $x^2 + 3x + 2$ by $x + 1$

[b] $37x^2 - 4 - 9x^4$ by $3x^2 - 2 + 5x$

Activity (1):

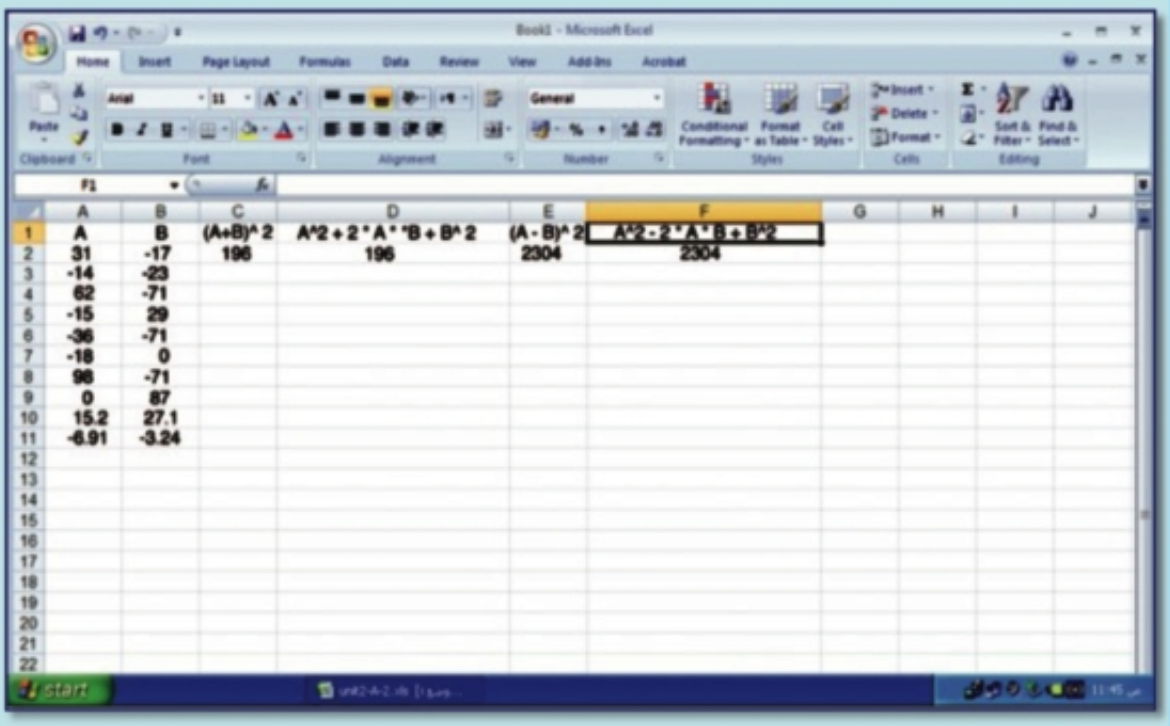
Use the spreadsheet "Excel" to verify the law: $a^m \times a^n = a^{m+n}$ applies to indices



- Extend your spreadsheet up to row 15 using other positive values of a , m , and n
- Does the law produce consistent outcomes?
- Does the law apply to negative bases ($a < 0$)?
- Use the same method to verify the law $a^m \div a^n = a^{m-n}$, $m \geq n$, and $a > 0$
- Does the law apply to negative bases ($a < 0$)?
- Attach a printed copy of your completed spreadsheet to show your work.

Activity (2):

1 **Copy the following table on a spreadsheet (Excel):**



A	B	C	D	E	F
A	B	(A+B)^ 2	A^2 + 2 * A * B + B^ 2	(A - B)^ 2	A^2 - 2 * A * B + B^2
31	-17	196	196	2304	2304
-14	-23				
62	-71				
-15	29				
-36	-71				
-18	0				
98	-71				
0	87				
15.2	27.1				
-6.91	-3.24				

[a] Verify that $(a + b)^2 = a^2 + 2ab + b^2$, by completing columns C and D.

Write the formula used in C_2 .....

Write the formula used in D_2 .....

[b] Verify that $(a - b)^2 = a^2 - 2ab + b^2$, by completing columns E and F.

Write the formula used in E_2 .....

Write the formula used in F_2 .....

[c] Extend your spreadsheet up to row 15 with numbers of your choice, and then complete columns C to F. Describe your observations.

2 [a] Using a similar table as in question 1, verify that $a^2 - b^2 = (a + b)(a - b)$.

[b] Have a copy of your work.

Unit Test

1 Complete:

[a] $(x + 5)(x + ...) = x^2 + ... + 15$

[b] $(2x + 1)^2 = 4x^2 + ...$

[c] Sometimes a product of 101 x 99 can be found quickly by multiplying two binomials

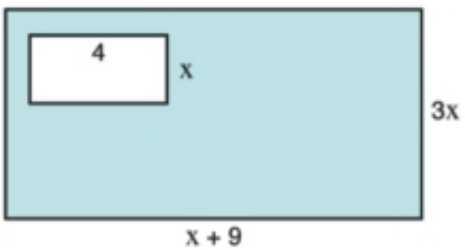
$(100 + 1)(.....)$

[d] If a = 2b and b = 15, then the numerical value of a + 2b + 5 is .....

[e] If a + 3b = 7, and c = 3, then the numerical value of a + 3 (b + c) is .....

[f] The area of the shaded region is

..... square units.



2 Circle the correct value:

[a] $3a^4 b \times 5a^2 b^2 \times 2a^3 = ...$ [$60 a^{11} b^3$, $30 a^{10} b^2$, $150 a^{10} b^3$, $30 a^9 b^3$]

[b] The cube of the sum of a and b is ..... [$a^3 + b^3$, $(a + b)^3$, $a^3 b^3$, $3a^3 b^3$]

[c] $(4x - 3)(x - 4) = ...$ [$4x^2 - 19x - 12$, $4x^2 - 7$, $4x^2 - 12$, $4x^2 - 19x + 12$]

[d] If the lateral area of a cube is $36x^2$, then its side length equals.....

[9x , 9 , 3x , 3]

[e] $(x - 2)(x^2 + 2x + 4) = ...$ [$x^3 + 8$, $x^3 - 8$, $3x + 6$, $x^3 + 6$]

[f] $(x^2 + x) \div x = ...$ [0 , x , 2x + 1, x + 1]

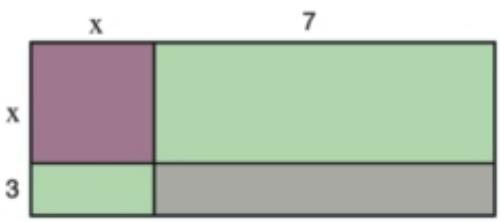
3

[a] If a = 3x – 4, b = x + 2, and c = 2x – 3

calculate the numerical value of $ab - c^2$

when x = 0

[b] This figure is a rectangle made up of 4 parts, write an algebraic expression which represents the area of the rectangle.



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4 **Write ☑ for the correct statement, and ☒ for the incorrect one:**

[a] $3x^4$ is an algebraic term of the degree 4 ☐

[b] The algebraic terms $7x^2$, and $2x^7$ are like terms ☐

[c] The algebraic expression $3xy + 5$ is of the second degree. ☐

[d] $2x - 3y$ is the additive inverse of $3y - 2x$ ☐

[e] $b^3 = 3 \times b \times b$ ☐

[f] $(x + 2)^2 = x^2 + 4$ ☐

5 [a] Divide $x^3 y - 4x y^2 + 6xy$ by xy

[b] Find the result by identifying the H.C.F.

1) $17^2 - 8 \times 17 + 17$

2) $6 \times 30 + 18 \times 15 - 24 \times 15$

6 [a] Subtract $5x^2 + y^2 - 3xy$ from $x^2 - 2xy + 3y^2$

[b] Simplify: $(7x y - 3x)^2 - (5x y - x)^2$

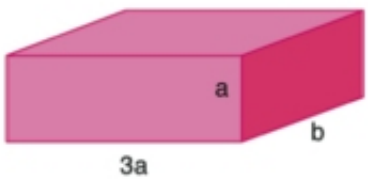
7 **Calculate the numerical value of the following using substitution when $a = -1$, $b = 2$:**

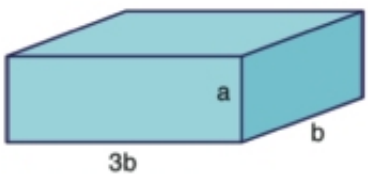
$(2a + 3b) - (3a - 2b)$

8 [a] Use Mental Math to calculate:

1) $(99.1)^2$ 2) 33×27

[b] Two metal cuboids with dimensions as shown were melted and reshaped to a new cuboid with the height $(a + b)$. Calculate the area of its base.





9 **Find the value of K which makes:**

[a] $6x^3 - 13x^2 - 13x + K$ is divisible by $3x - 5$

[b] $x^3 - 3x^2 - 25x + K$ is divisible by $x^2 + 4x + 3$

Unit 3

Statistics

Carl Friedrich Gauss
(1855 – 1777)

The methods, theories and applications of statistics have been developed by a large number of scientists who discussed its theories and constructed them on sound scientific bases. Among those mathematicians is the german mathematician Carl Friedrich Gauss.

Contents

Lesson 1 : Reading and interpreting data.

Lesson 2 : Representing data.

- Activity.
- Unit Test.

Lesson 1 Reading and interpreting data

Agriculture is an important pillar sectors of economic development.

Bar charts

This table shows the types of livestock in Egypt over a period of 4 years (2002-2005).

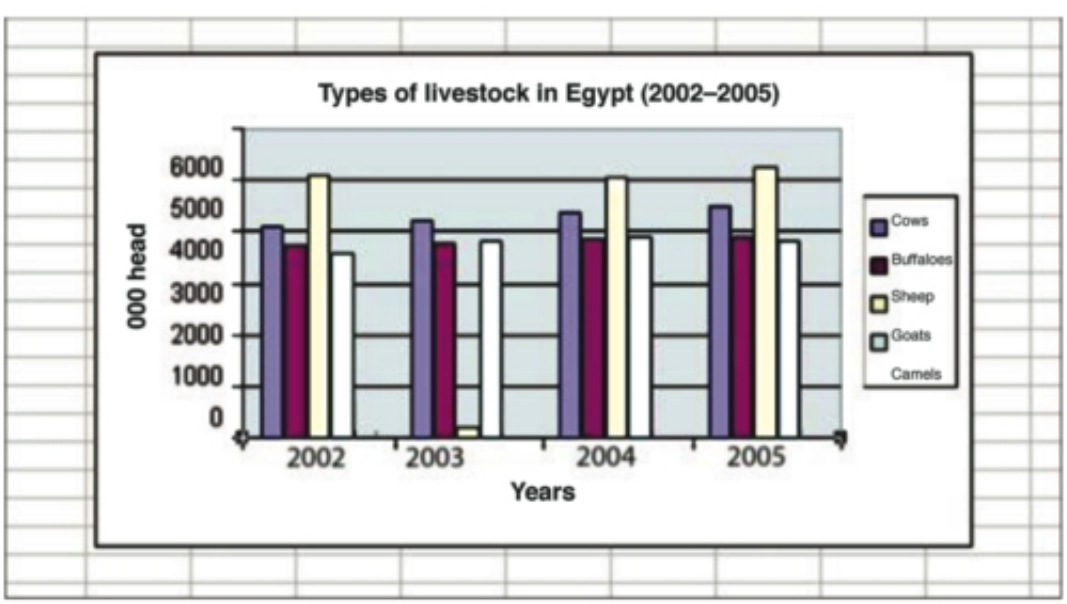
Note that the values in the table stand for thousands.

For Example: in 2003 the number of camels was 136 000 and the number of cows was 4 227 000.

Types of livestock in thousands				
Livestock	2002	2003	2004	2005
Cows	4082	4227	4369	4495
Buffaloes	3717	3777	3845	3885
Sheep	5105	193	5043	5232
Goats	3582	3811	3879	3803

This allows us to use a vertical scale with a smaller range for the number of livestock but enables us to compare their real numbers. The horizontal scale indicates the years.

This comparative bar chart produced from the table helps us to compare the numbers of livestock within a year and across years. Each type of livestock have their own 'bar' and are identified by the 'key'.



Sourced form "Ministry of Agriculture and Land Reclamation" www.copmas.gov.eg

Exercise (3–1)

1 Place a ruler horizontally over the bar chart then complete the following tab by put (✓) in front of the type of livestock which is:

[a] greater than 4000 000

	2002	2003	2004	2005
Cows				
Buffaloes				
Sheep				
Goats				
Camels				

[b] greater than 3000 000

	2002	2003	2004	2005
Cows				
Buffaloes				
Sheep				
Goats				
Camels				

2 Refer to the livestock bar chart and write T for true or F for false for these statements:

[a] The lowest numbers of recorded livestock from 2002 to 2005 are camels. ☐

[b] The number of rabbits are not recorded so there are no rabbits in Egypt. ☐

[c] From 2002 to 2005 there was an increase in all recorded livestock. ☐

[d] The greatest numbers of recorded livestock from 2002 to 2005 are sheep. ☐

3 This table shows Ahmed's percent (%) marks in the end of year examinations, in five subjects, from 2004 to 2007

(%) Marks in end of year examinations				
Subjects	2004	2005	2007	2008
Maths	64	46	66	72
Chemistry	74	65	59	64
Physics	58	61	48	65
Biology	59	58	67	66
language	67	65	73	71

Draw a comparative bar chart for Ahmed's examination results which has:

[a] a horizontal axis for four groups of four colour coded bars of 0.5 cm width;

[b] a vertical axis of scale 1 cm = 10% for marks;

[c] an accurate title.

4 Place a ruler horizontally over the 55% line on the bar chart and record which subjects and in what year were Ahmed's grades below 55%.

5 Refer to Ahmed's chart and write two true statements and one false statement:

[a] The true statements should indicate correct deductions from the chart;

[b] The false statements should indicate an incorrect deduction from the chart;

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Line graphs

This table shows the cultivated land areas for winter crops in Egypt (2001-2005).

Note that the feddan values in the table stand for thousands.

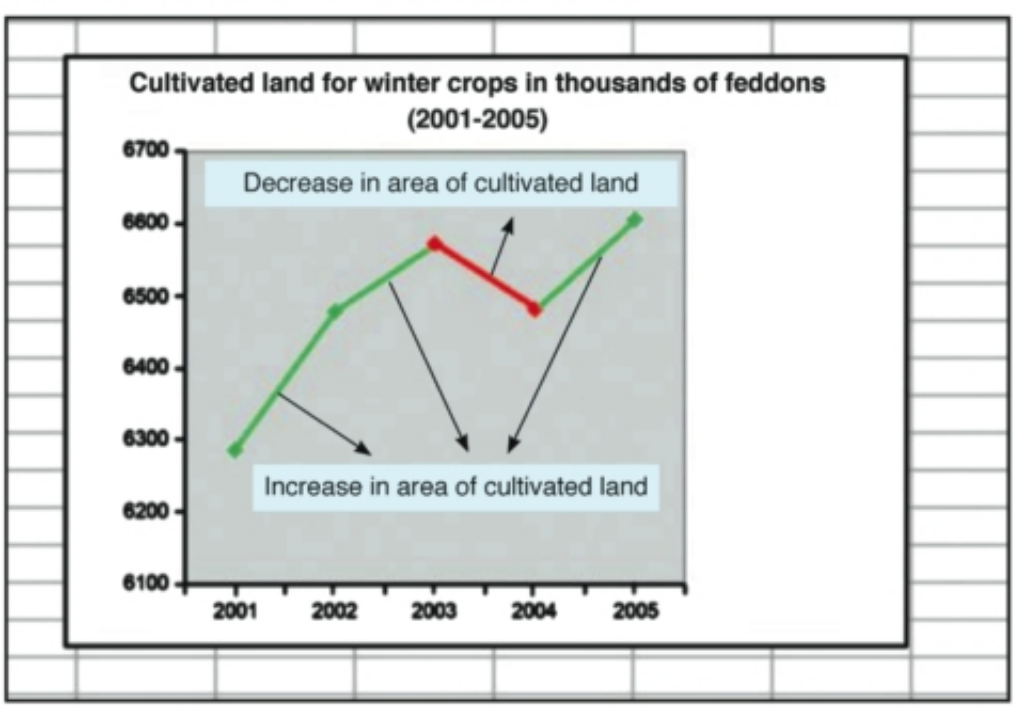
For Example: in 2003 the total land area for the cultivation of lentils was 4000 feddans and 2 539 000 feddans for the cultivation of clover.

Note that the range of total cultivated land is from 6 286 000 feddans to 6607000 feddans. The scale on the vertical axis does not start at 0 but ranges from 6100 000 to 6700 000 feddans.

The horizontal scale indicates the years in which the data was collected.

The line graph produced from the table helps us to identify the increase or decrease in the total cultivated land area for winter crops.

Cultivated land for winter crops in thousands of hectares					
Crops	2001	2002	2003	2004	2005
Wheat	2342	2450	2506	2605	2985
Beans	363	348	286	274	224
Barley	237	229	216	245	248
Clover	2499	2564	2539	2421	2110
Beet	143	154	131	141	167
Veg(1)	692	734	893	796	873
Total	6286	6479	6571	6482	6607



(1) Vegetables: Potatoes, tomatoes, other veg.

Exercise (3–2)

From the previous line graph.

1 Complete using 'increased' or 'decreased' to show the area cultivated with winter crops:

[a] The total area of cultivated land ..... from 2002 to 2003.

[b] The total area of cultivated land ..... from 2003 to 2004.

[c] The total area of cultivated land ..... from 2004 to 2005.

2 Refer to the cultivated land line graph and write T for true or F for false for these statements:

[a] The lowest recorded cultivated land area was in 2001 ☐

[b] A cultivated land area decreased from 2003 to 2004. ☐

[c] A cultivated land area increased from 2002 to 2004. ☐

[d] A cultivated land area decreased from 2002 to 2003. ☐

[e] A cultivated land area increased from 2002 to 2004. ☐

[f] The green line with the greatest slope shows the increase in cultivated land area from 2004 to 2005. ☐

[g] The cultivated land area decreased from 2001 to 2005 ☐

3 The following table shows the area of the lands cultivated with "Nile crops" in thousand feddans from 2002-2006.

Draw a line graph for the data, and write a suitable title.

Then complete these sentences using 'increased' or 'decreased':

[a] The total area of cultivated land ..... from 2002 to 2003.

[b] The total area of cultivated land ..... from 2003 to 2004.

[c] The total area of cultivated land ..... from 2004 to 2005.

[d] The total area of cultivated land ..... from 2005 to 2006.

Cultivated land for winter crops in thousands of feddans (2002–2006)					
Crops	2002	2003	2004	2005	2006
Rice	=	=	=	1	4
Sorghum	7	8	8	9	4
Maize	281	307	307	277	246
Potatoes	48	45	60	46	39
Veg(1)	179	183	167	164	178
Others(2)	91	87	98	109	119
Total					

(=): less than thousand feddan
veg. (1): onion.
Others (2): Corn.

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Pie charts

This table shows the numbers of tourists who visited Egypt in thousands over a five year period.

In the year 2002 the total number of tourists is 5192. This is equivalent to 100% of the tourists for that year.

The percentage of European tourists in 2002 is calculated thus:

$$\frac{3584}{5192} \times 100\% = 69.032\%$$

= 69% (to the nearest unit)

Tourism (2002 to 2005)				
Origin	2002	2003	2004	2005
Americans	171	188	257	298
%	3			
Arabs	1128	1322	1496	1703
%	22			
Europeans	3584	4204	5920	6120
%	69			
Others	309	331	431	487
%	6			
Total	5192			
%	100	100	100	100

1 [a] Calculate and write the total number of tourists in each category from year 2003 to 2005.

[b] Calculate and write, correct to 1 decimal place, the percentage of each category of tourists from year 2003 to 2006.

Comparing percentages is easier than comparing up to 4 digit numbers.
A diagrammatic comparison would be even better.
The 'pie chart' is a means of comparing data and it is shown as sectors of a circle.

The percentage of European tourists in 2002 can be converted to a sector of a circle thus:

$$\frac{69}{100} \times 360° = 248.4°$$

= 248° (correct to the nearest °)

[c] Convert the percentages in the other sections of this table to angles in sectors of a circle using the same method. Write the angles in the table. The angles can now be used to draw a pie chart

The sum of the measures of the central angles = 360°

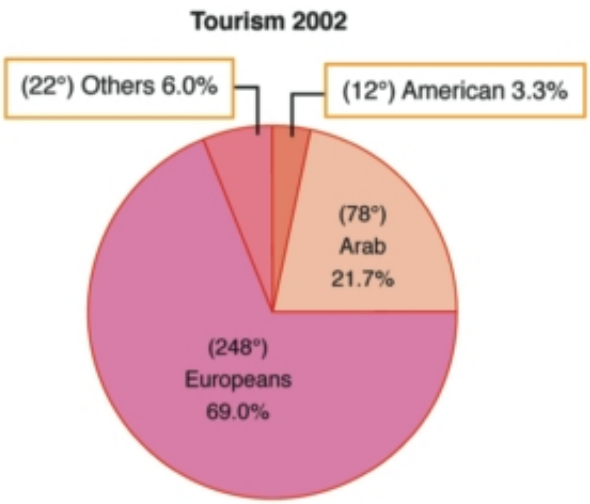
	2002	
Americans	171	
%	3	.....°
Arabs	1128	
%	22	.....°
Europeans	3584	
%	70	248°
Others	309	
%	6	.....°
Total	5192	
%	100	

The angles that you calculated can be used to form this pie chart.

Notice that each sector is labelled and the pie chart has a title.

A pie chart enables the comparison of sets of data within one diagram.

The details of the data are available in the labelling.



2 [a] Calculate the central angles of each sector of the pie chart of the number of tourists from year 2003 to 2005
Write the values in the appropriate table.

[b] Use the values for the angels to draw the sectors of a pie chart for number of Tourists from 2003 to 2005.

[c] Ensure that each pie chart has a title and that the sectors are correctly labelled.

	2003	
Americans	188	
%	3	.....°
Arabs	1322	
%	22	.....°
Europeans	4204	
%	70	.....°
Others	331	
%	6	.....°
Total	6045	
%	100	

	2004	
Americans	257	
%	3	.....°
Arabs	1496	
%	19	.....°
Europeans	5920	
%	73	.....°
Others	431	
%	5	.....°
Total	8104	
%	100	

	2005	
Americans	298	
%	4	.....°
Arabs	1703	
%	20	.....°
Europeans	6120	
%	71	.....°
Others	487	
%	6	.....°
Total	8608	
%	100	

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Lesson 2 Representing data

The mode

A Survey of the weights, to the nearest kilogram, of 40 secondary school students in a class was conducted.

Weights of preparatory school students Date: / /2008

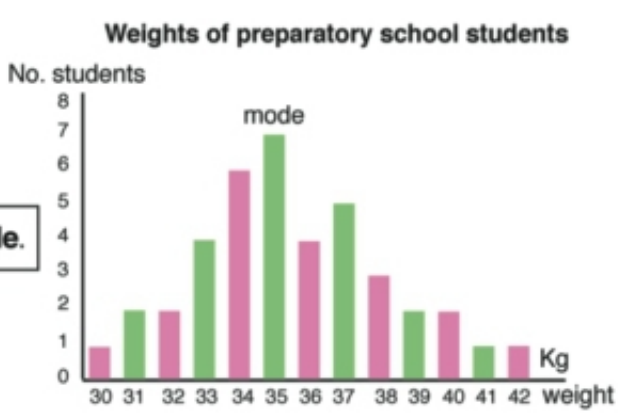
Name	Kg	Name	Kg	Name	Kg	Name	Kg
Gamal	38	Ahmed	42	Amany	34	Basant	33
Fathy	35	Zakria	36	Amira	30	Norhan	34
Bahgat	31	Mohamed	38	Amal	36	Marian	37
Salah	37	Aly	33	Mariam	32	Safaa	31
Abd El wahab	36	Sameh	39	Hoda	37	Enayat	35
Al brens	34	Yassin	32	Samah	40	Safia	39
Nael	33	Mahmod	35	Sanaa	35	Sawsan	36
Waleed	35	Tarek	37	Howida	33	Samia	34
Samer	38	Kamel	41	Fatma	37	Mervat	34
Ashraf	34	Abdalla	40	Aisha	35	Maha	35

The data is arranged in a frequency table:

Weights (kg)	30	31	32	33	34	35	36	37	38	39	40	41	42
Number of students	1	2	2	4	6	7	4	5	3	2	2	1	1

The frequency table data was represented by a bar graph.

1. What was the most common weight?
2. How many students weighed the same as the most common weight?



The weight that occurs most often is the **mode**.

Exercise (3–3)

1 **This frequency table shows the weights of 40 primary school pupils.**

Weights of Primary school students: Date: / / '08													Survey total: 40
kg	20	21	22	23	24	25	26	27	28	29	30	31	32
Number of pupils	1	1	2	4	4	5	8	4	4	3	2	1	1

[a] Draw a bar chart for the frequency table data.

[b] Identify and write the mode weight of the primary school pupils.

2 50 families were surveyed about the 'number of children in the family', this raw data was produced.

4	2	3	1	6	0	7	6	2	6	2	0	1
4	2	5	0	1	6	1	4	5	1	8	9	3
0	7	0	1	5	2	4	2	1	4	6	3	6
4	2	4	0	8	4	3	4	3	3	5		

[a] Use this table and the tally method to from a frequency table for the data.

Children in families. Date: / / '08										**Survey total: 50**
Number of children	-	1	2	3	4	5	6	7	8	9
Tally										
Frequency										

[b] Identify and write the modal number of children in the families surveyed.

3 50 students were surveyed about the 'number of books they had read in a year. This raw data was produced.

6	3	4	5	6	8	4	3	5	2	5	4	6
3	9	3	4	2	3	1	6	4	7	6	2	6
2	7	6	4	2	4	3	8	1	4	2	5	2
4	10	7	3	7	5	2	4	3	4	3		

[a] Draw a table like the one in question 2 and use the tally method to from a frequency table for the data.

[b] Find the mode for the numbers of books which the pupils had read.

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The median

A heights of a youth football of 20 players was recorded.

Number of player	height (cm)
1	164
2	158
3	161
4	156
5	170

Number of player	height (cm)
6	157
7	160
8	154
9	169
10	171

Number of player	height (cm)
11	152
12	159
13	163
14	164
15	169

Number of player	height (cm)
16	156
17	167
18	162
19	171
20	153

The data is arranged in a frequency distribution table:

Heights of youth football. Date: / / '08 Survey total: 20										
Cm	152	153	154	155	156	157	158	159	160	161
Number of players	1	1	1	-	2	1	1	1	1	1
Cm	162	163	164	165	166	167	168	169	170	171
Number of players	1	1	2	-	-	1	-	2	1	2

If the players are arranged in ascending order (from shortest to tallest) there will be two players in the middle:

median

.... 157 158 159 160 **161** **162** 163 164 165 166 ....

The **median** height $= \frac{161+162}{2} = \frac{323}{2} = 161.5\text{cm}$

In your class, work in groups of 9 or 10 students:

1. Measure and record the heights of all the students in your group. Two students should identify and check each height. One student should record the height. Everyone in turn, should be involved measuring and recording heights.
2. Identify the range of heights from shortest to tallest and uses the tally method to record the frequency of each height. Draw a frequency table.
3. For the groups of 9, the median height will be the 5th height. For the groups of 10 calculate the median height by adding the 5th and 6th height and dividing them by 2.
4. Use all the data to identify or calculate the median height of the class.

Drill : If a player whose height 172cm joined the team, then find the median in this case.

Exercise (3–4)

1 This table shows the marks of four students in mathematics, chemistry, physics, biology and history tests.

[a] Write the marks for each student in order.
[b] Write the median mark for each student.

	Ma	Ch	Ph	Bi	Hi
Ahmed	15	6	3	8	11
Hanna	8	7	5	9	13
Mahmod	12	13	9	10	7
Thoraia	10	8	9	12	14

Ahmed						Median	
Hanna						Median	
Mahmod						Median	
Thoraia						Median	

2 This table shows the number of hours that two athletes trained in each month of the year.

Gamal	75	72	68	46	57	66	63	70	58	30	48	53
Biomy	62	64	54	52	63	68	56	65	70	50	49	57

[a] Write the hours of training for each athlete in order.
[b] Write the median hours of training for each athlete.

3 Scores in a frequency distribution table are arranged in order.

Score	5	6	7	8	9	10	11	12
Frequency	2	7	6	4	4	3	2	1

In this distribution there are:
2 scores of 5
7 scores of 6
6 scores of 7, and so on.
Since there are 29 scores, then the 15th score is the median or middle score.
[a] Find the median of the scores.
[b] Find the mode of the scores.

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The mean

The maximum and minimum temperatures for four locations in Egypt in °C.

	Cairo		Alexandria		Luxor		Aswan	
	Max	Min	Max	Min	Max	Min	Max	Min
January	19	9	18	9	23	5	24	8
February	21	9	19	10	25	7	26	9
March	24	11	21	11	29	11	30	13
April	28	14	24	15	35	16	36	18
May	32	17	27	17	39	21	39	21
June	35	20	28	20	41	23	42	24
July	35	22	30	23	41	24	42	25
August	35	22	30	23	41	24	41	25
September	23	20	30	21	39	22	40	22
October	30	18	28	18	35	18	37	19
November	24	12	24	15	30	12	30	15
December	21	10	20	11	25	8	21	10

The January **mean** for the maximum temperatures in the four locations

$$= \frac{\text{Sum of the maximum temperatures}}{\text{The number of temperatures}}$$

$$= \frac{19 + 18 + 23 + 24}{4} = \frac{84}{4} = 21$$

Complete:

The August **mean** for the minimum temperatures in the four locations

$$= \frac{\ldots\ldots + \ldots\ldots + \ldots\ldots + \ldots\ldots}{\ldots\ldots}$$

$$= \frac{\ldots\ldots}{\ldots\ldots} = \ldots\ldots \text{ °C (to the nearest unit)}$$

Exercise (3–5)

1 **Complete:**

[a] The mean maximum temperature for 2007 in Cairo = $\frac{\text{The sum of the maximum temperatures}}{\text{The number of maximum temperatures}}$

$$= \frac{19 + 21 + 24 + 28 + 32 + 35 + 35 + \ldots\ldots + \ldots\ldots + \ldots\ldots + \ldots\ldots + \ldots\ldots}{12}$$

$$= \frac{\ldots\ldots}{12} = \ldots\ldots = \ldots\ldots^{\circ}$$

[b] The mean maximum temperature in Alexandria

$$= \frac{\ldots + \ldots + \ldots + \ldots + \ldots + \ldots + \ldots + \ldots + \ldots + \ldots + \ldots + \ldots}{12}$$

$$= \frac{\ldots\ldots}{\ldots\ldots} = \ldots\ldots = \ldots\ldots^{\circ}$$

[c] the mean maximum temperature in Luxor = ...

[d] the mean minimum temperature in Aswan = ...

2 This table shows the number of hours that two athletes trained in each month of the year.

Gamal	75	72	68	46	57	66	63	70	58	30	48	53
Biomy	62	64	54	52	63	68	56	65	70	50	49	57

[a] Calculate Gamal's mean hours of training.

[b] Calculate Biomy's mean hours of training.

3 This table shows the marks of four students in mathematics, chemistry, physics, biology and history tests.

[a] Calculate the mean mark for each student in the five tests.

[b] Calculate the mean mathematics mark for each student in the four tests.

[c] Which subject has the highest mean mark?

	Ma	Ch	Ph	Bi	Hi
Ahmed	15	6	3	8	11
Hanna	8	7	5	9	13
Ashraf	12	13	9	10	7
Faten	10	8	9	12	14

Activity:

This table shows the population and land area of Desert Governorates.

The data can be inserted in a computer's Excel programme and charts can be produced.

Desert Governorates		
Governorate	Population	Area (km^2)
Red Sea	288 233	203 685
New Valley	187 256	376 505
North Sinai	339 752	27 574
Matruh	322 341	212 112
South Sinai	149 335	33 140

1 Select "start" ⟶ "programs" ⟶ Select "microsoft Excel"

2 To enter the data for land area in the Desert Governorates: Select cell A1, type 'Red Sea' press ↵ to go to A2: Type 'New Valley'. Continue ↵ to go to A3 - A5 and type 'North Sinai' , Matruh' , 'South Sinai'. Select cell B1, type '203685'. Press ↵ to go to B2: Type '376505'. Continue ↵ to go to B3 - B5 and type ' 27574' , 212112', '33140'.

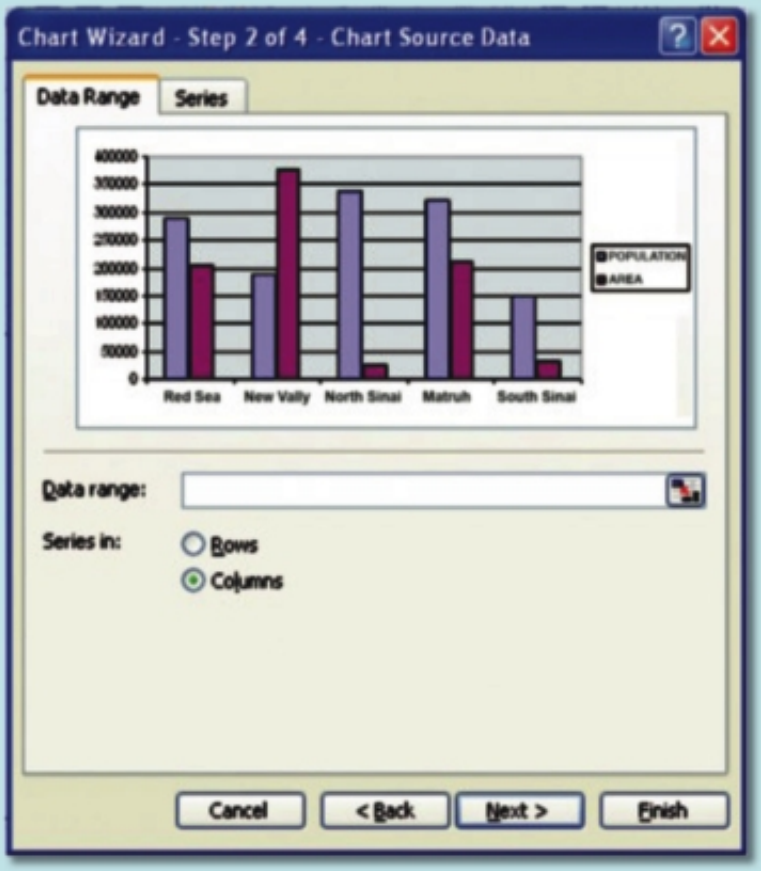
3 Identify Cells A1 to B5.

4 Go to 'Insert' and click 'Charts'.

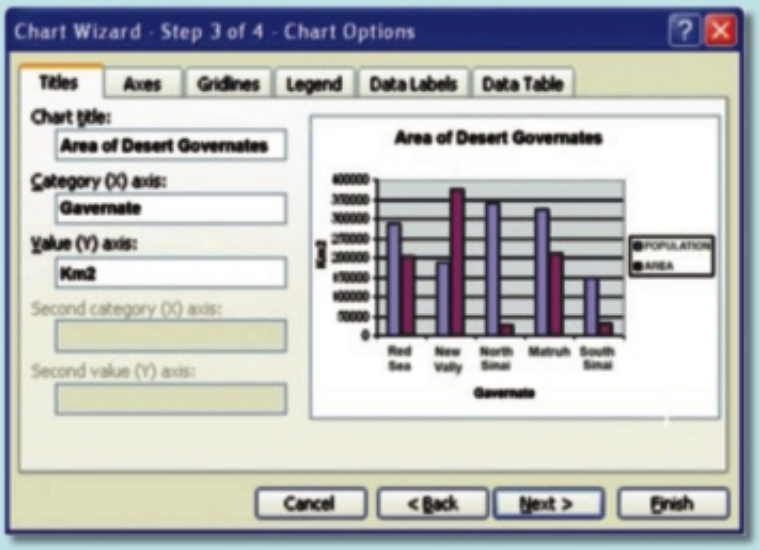
Dialog Box:

- Chart wizard - step 1 of 4 - Chart Type - click 'Column' , Click 'Next >'.

- Dialog Box: Chart Wizard - Step 2 of 4 - Chart Source Data - Click 'Next >'.



- Dialog Box: Chart Wizard – Step 3 of 4 - Chart Options - Click 'Titles'.
  - Chart title: Type - Area of Desert Governorates.
  - Category X - axis: Type - Governorate.
  - Value y - axis: Type – km^2
  - Click "Next >".



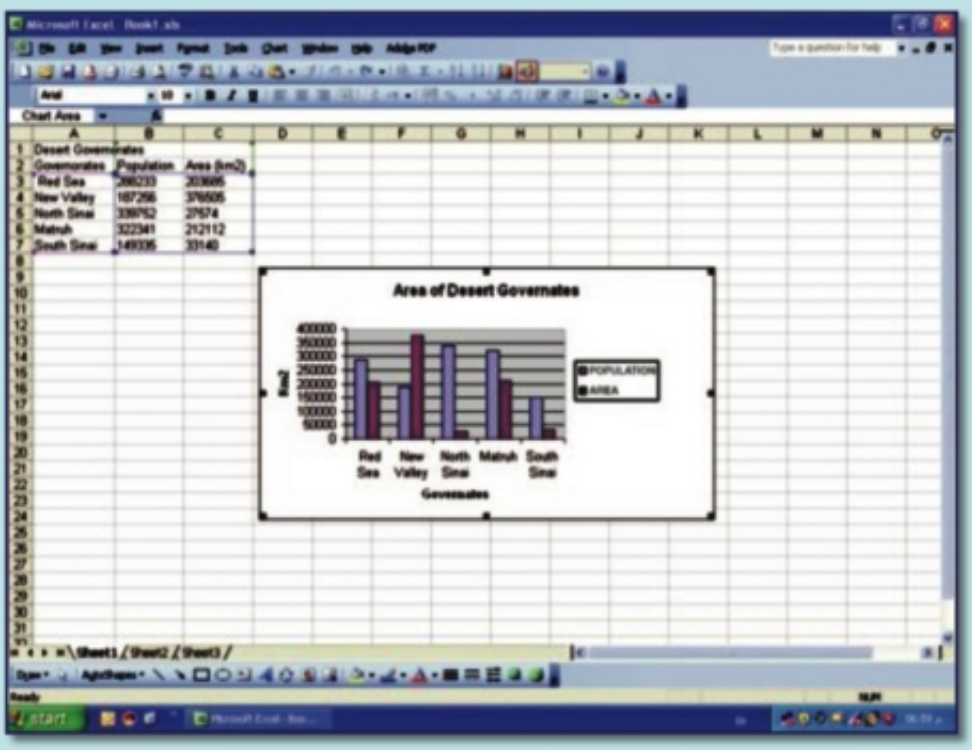
- Dialog Box: Chart Wizard - Step 4 of 4 - "Chart Location" - Click "Finish".

5 Save. Name file - DesGov'08.

The bar chart's data can also be included.

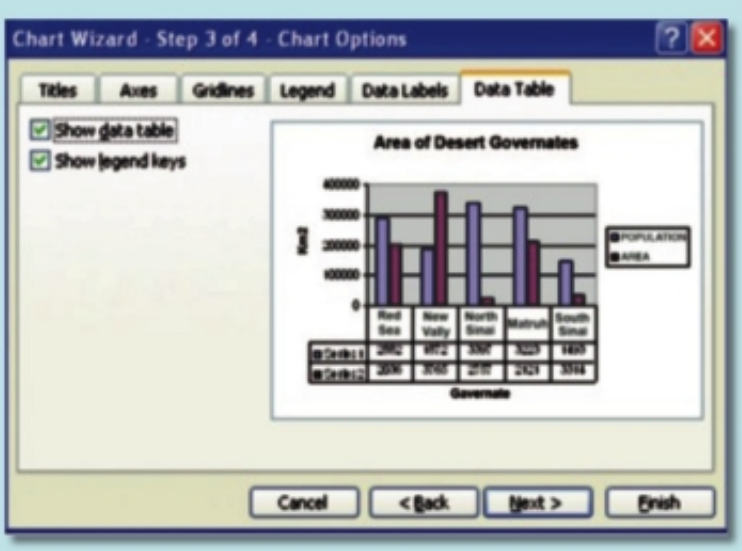
6 Return to file: DesGov'08. Click 'Chart options'.

7 Dialog Box: Click 'Data Table'.



8 Dialog Box: Click 'Show Data table'

9 Click 'Ok': Print and place a copy in your portfolio



Unit Test

1 ☑ The correct value:

[a] The mode of these numbers 3, 6, 10, 13, 19, 19, 21 is:

[21 ☐ , 19 ☐ , 17 ☐ , 13 ☐]

[b] The mean of these numbers 2, 5, 8, 9, 14, 28, is: [6 ☐ , 8 ☐ , 9 ☐ , 11 ☐]

[c] The median of these numbers 2, 5, 5, 6, 7, 9, 11, 14, 16, 21 is:

[7 ☐ , 8 ☐ , 9 ☐ , 16 ☐]

[d] Complete the table for this set of numbers: 4, 1, 2, 3, 5, 8, 10, 4, 3, 7, 4, 8

Number	1	2						
Tally	/	/						
Frequency	1	1						

The mode of the numbers is: [1 ☐ , 2 ☐ , 4 ☐ , 10 ☐]

[e] Write these numbers in ascending order:

2.9, 2.3, 1.6, 9.1, 2.8, 0.7, 8.1, 7.3, 6.2, 5.3, 12.2, 4.3, 8.5

Then the median of the numbers is: [2.8 ☐ , 4.3 ☐ , 5.3 ☐ , 6.2 ☐]

[f] Write these numbers in ascending order:

17.9, 7.4, 25.7, 8.9, 16.6, 3.8, 10.3, 32.3, 13.7, 0.5, 20.3, 16.3

The median of the numbers is: [13.7 ☐ , 15 ☐ , 16.3 ☐ , 32.3 ☐]

2 Ashraf recorded the length of his bus journeys to school for 3 weeks:

He wrote times to the nearest minute

15 17 16 16 17 15 13 22 14 25 17 16 18 15 19

[a] Identify the median time.

[b] Identify the modal time.

[c] Calculate the mean time.

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3 These are the heights, in cm of 10 year 7 students.

124 124 126 130 128 116 140 130 118 122

Calculate the mean height to the nearest cm.

4 The following table shows the number of hours that Mohmoud and Mohamed study daily in a week.

Mahomoud	7	5	8	9	8	6	4
Mohamed	8	9	7	9	9	5	5

[a] Find the mean of studing hours for each of Mahmoud and Mohamed.

[b] Find the median hours for each of them.

[c] Find the the mode hours for Mohamed.

Unit 4

Geometry and measurement

Euclid

(325 BC - 265 BC)

Euclid is a Greek Mathematician Scientist, He lived in Alexandria, is considered the father of Geometry, he said that "What made without evidence can be refused without evidence"

Definitions:

The point is what it is not part.

The straight line has neither length not width.

Some axioms:

A straight line segment can be drawn by joining any two points.

A straight line segment can be extended indefinitely in a straight line.

All right angles are equal.

CONTENTS

Lesson 1 Geometric Concepts.

Lesson 2 Congruence

Lesson 3 Congruent triangles

Lesson 4 Parallelelism

Lesson 5 Geometric constructions

- Unit test

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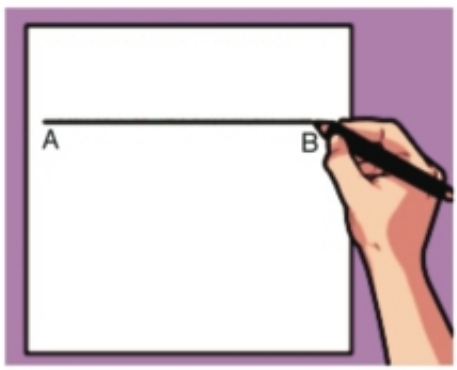
Lesson 1 Geometric concepts

The line segment

Mark two points on a sheet of paper which is a representation of a plane in geometry.

If we join them with a straight edge, we have a line segment. The two points we joined are called end points. IF we name these two points A and B, we get a line segment AB is written as $\overline{AB}$ or $\overline{BA}$.



The straight line

If we extend the line segment AB in both directions indefinitely, we will get what we call, in geometry, a straight line. A straight line AB, Written as $\overleftrightarrow{AB}$, or $\overleftrightarrow{BA}$.

There is an infinite number of points on the straight line, the arrows show that the line can be extended without limit on both sides

The ray

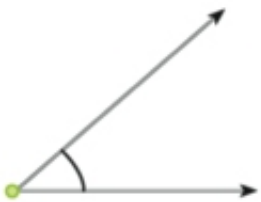
If we extend the line segment AB in either direction indefinitely, we will get a ray AB, or a ray BA.

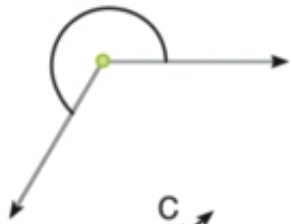
Ray AB is written as $\overrightarrow{AB}$, where the ray starts at A and continuous without end from A through B in a straight line so it is infinitely long. Thus its length is not determined.

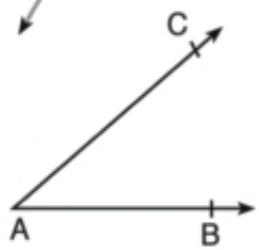
Then: $\overline{AB} \subset \overleftrightarrow{AB}$, $\overrightarrow{AB} \subset \overleftrightarrow{AB}$, $\overrightarrow{BA} \subset \overleftrightarrow{AB}$

The angle

We can view an angle as the rotation of a ray from one position to another around the starting point.







If A, B and C or three non-collinear points then $\overrightarrow{AB}$, $\overrightarrow{AC}$ form the angle BAC and is written as $\angle BAC$, $\overrightarrow{AB} \cup \overrightarrow{AC} = \angle BAC$

The angle is the union of two rays with the same starting point.
The common point of the two rays is called the vertex of the angle.
Each of the two rays is called a side of the angle.

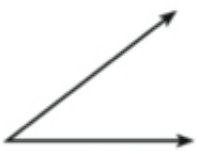
The angle divides its plane into three sets of points which are:

- The angle.
- The interior of the angle.
- The exteior of the angle.

Types of angles

Angles are classified according to their measures as follows:

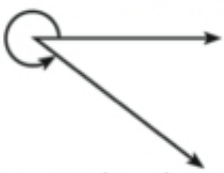
An angle of 90° is called a right angle



An angle of less than 90° But is greater than Zero° is called an acute angle

An angle of greater than 90° but less than 180° is called an obtuse angle

a straight angle is an angle whose measure is 180°



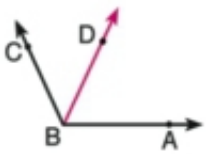
An angle that is greater than 180° but less than 360° is called a reflex angle

Zero angle is an angle whose measure is zero, where its sides are coincident

Some relations between the angles

Adjacent angles

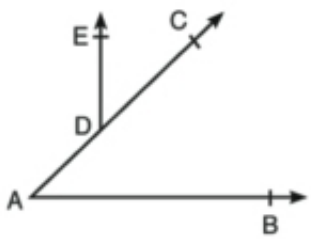
Two angles are said to be adjacent if they have a common vertex, a common side and the other two sides are on opposite sides of the common side.



∠ABD, ∠DBC are adjacent

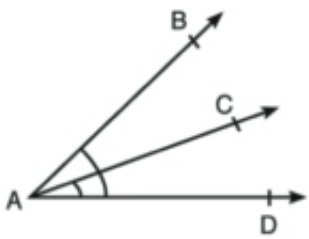
Notice that:

1



∠BAC and ∠EDC are not adjacent because they have not a common vertex

2

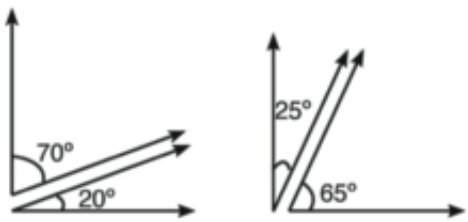


∠BAC and ∠BAD are not adjacent because the sides $\overrightarrow{AC}$ and $\overrightarrow{AD}$ are not on the opposite sides of $\overrightarrow{AB}$

Complementary angles

Suppose we are given two pairs of angles, 25°, 65° and 70° , 20°.

What do you notice about the sum of each pair of angles?



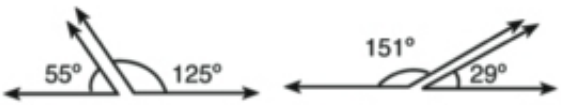
20° + 70° = ...° 65° + 25° = ...°

Two angles are said to be complementary if their sum is 90°.

Supplementary angles

We are given two pairs of angles, 125°, 55° and 151°, 29°.

What do you notice about the sum of each pair of angles?



125° + 55° = ...° 151° + 29° = ...°

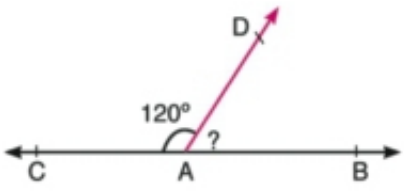
Two adjacent angles formed by a straight line and a ray with a starting point on this straight line are supplementary

m (∠BAC) + m (∠CAD) = 180°

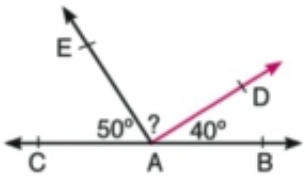
Dirll

1 In each of the following figures:

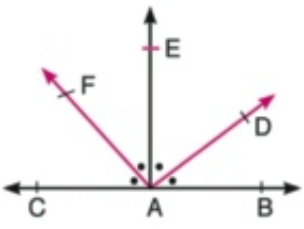
If A ∈ $\overleftrightarrow{BC}$, then complete:



m (∠BAD) = ...°

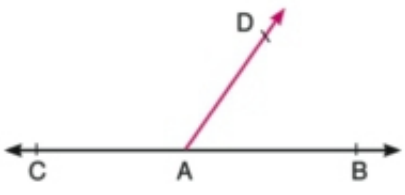


m (∠DAE) = ...°



m (∠BAD) = ...°

2 Draw the two adjacent angles BAD and DAC such that the sum of their measures is 180° . Repeat this work, what is the relation between $\overrightarrow{AB}$ and $\overrightarrow{AC}$?



If two adjacent angles are supplementary then their outer sides are on the same straight line.

$\overrightarrow{AB}$ and $\overrightarrow{AC}$ are on the same straight line.

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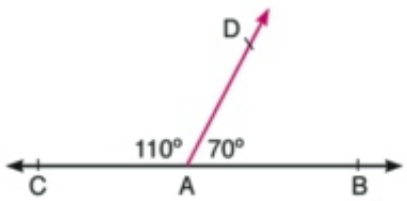
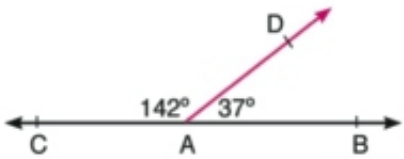
Example (1)



$\overrightarrow{AB}$ and $\overrightarrow{AC}$ are on the straight line because

m (∠BAC) + m (∠DAC) = 180°

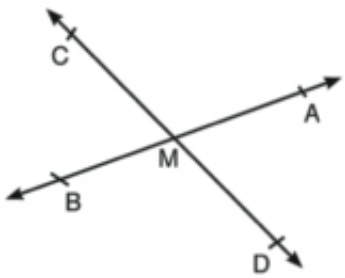


$\overrightarrow{AB}$ and $\overrightarrow{AC}$ are not on the same straight line because

m (∠BAD) + m (∠DAC) ≠ 180°

vertically opposite angles

Draw $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ to intersect at M , then measure the angles: AMC, CMB, BMD, and DMA what do you notice?



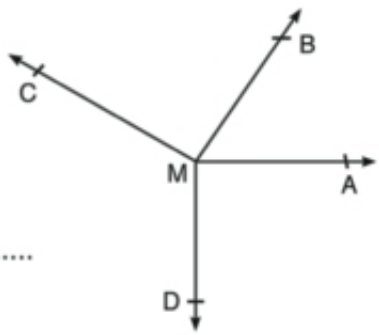
If two straight lines intersect, then the measures of each two vertically opposite angles are equal.

Accumulative angles at a point

From the point M, Draw $\overrightarrow{MA}$, $\overrightarrow{MB}$, $\overrightarrow{MC}$, $\overrightarrow{MD}$, then measure the resulted adjacent angles.

m (∠AMB) + m (∠BMC) + m (∠CMD) + m (∠DMA) = ...

Repeat this work, what do you notice?

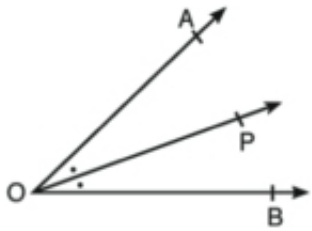


The sum of the measures of the accumulative angles at a point is 360°

Angle bisector

An angle bisector is a ray that divides an angle into two halves.

$\overrightarrow{OP}$ divides ∠AOB into two angles having the same measure and $\overrightarrow{OP}$ is called the bisector of ∠AOB.

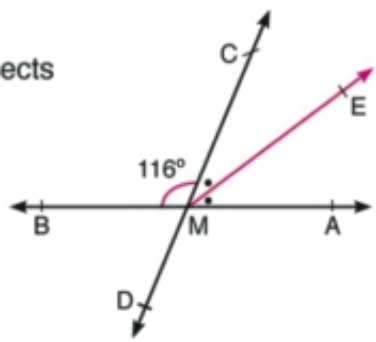


Example (2)

In the figure opposite,

M is the point of intersection of $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$, $\overrightarrow{ME}$ bisects ∠AMC, and m (∠BMC) = 116°

Find: m (∠AMC), m (∠AMD) , and m (∠AME)



Solution:

m (∠AMC) = 180° – 116° = 64°

m (∠AMD) = m (∠CMB) = 116° v. opp. angles

m (∠AME) = $\frac{1}{2}$ m (∠AMC) = $\frac{64°}{2}$ = 32°

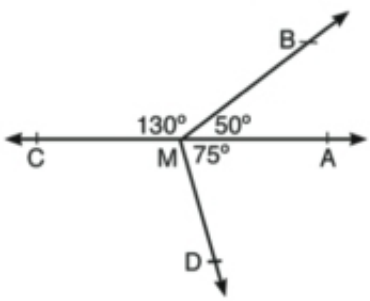
Example (3)

In the figure opposite,

Complete:

(1) m (∠CMD) = ...°

(2) ..... and ..... lie on the same straight line.



Solution:

(1) m (∠CMD) = 360° - (50° + 130° + 75°) = 105°

(2) $\overrightarrow{MA}$ and $\overrightarrow{MC}$ lie on the same straight line

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Exercise (4–2)

1 Complete:

[a] If m (∠A) = 80° then m (reflex ∠A) = ...°

[b] The measure of each of two equal complementary angles equals .....°

[c] If ∠A and ∠B are supplementary angles and

m (∠A) = 2 m (∠B) then m (∠B) = ...°

2 Draw an angle PQR:

[a] Measure ∠PQR.

[b] Draw ray $\overrightarrow{QS}$ between $\overrightarrow{QR}$ and $\overrightarrow{QP}$ such that m (∠SQR) = $\frac{1}{2}$ m (∠PQR).

[c] Does $\overrightarrow{QS}$ bisect ∠PQR?

[d] Produce $\overrightarrow{RQ}$ to T.

[e] Draw the bisector $\overrightarrow{QU}$ of ∠PQT

Measure the angles first before answering (f) and (g).

[f] Name all pairs of complementary angles.

[g] Name all pairs of supplementary angles.

3 [a] Use your protractor to draw angles which have the values

[a] 60° [b] 115° [c] 195° [d] 245°

Classify the angles into acute, obtuse and reflex angles.

[b] What are the supplements of the angles whose measures are?

[a] 10° [b] 117° [c] 82° [d] $92\frac{1}{2}$°

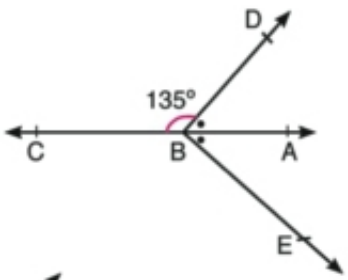
[c] What are the complements of the angles whose measures are?

[a] 37° [b] 48° [c] 45° [d] $22\frac{1}{2}$°

4 In the figure opposite,

If B ∈ $\overleftrightarrow{AC}$, m (∠DBC) = 135° and $\overrightarrow{BA}$ bisects ∠DBE find:

m (∠ABD), m (∠DBE), m (∠CBE)



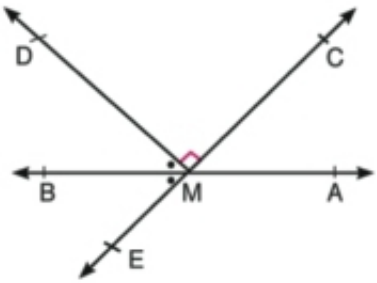
5 In the figure opposite,

If $\overleftrightarrow{AB}$ ∩ $\overleftrightarrow{CE}$ = {M},

$\overrightarrow{MD}$ ⊥ $\overrightarrow{CE}$ and $\overrightarrow{MB}$ bisects ∠DME find:

m (∠BME), m (∠DME),

m (∠AMC) and m (∠AME)



Lesson 2

Congruence

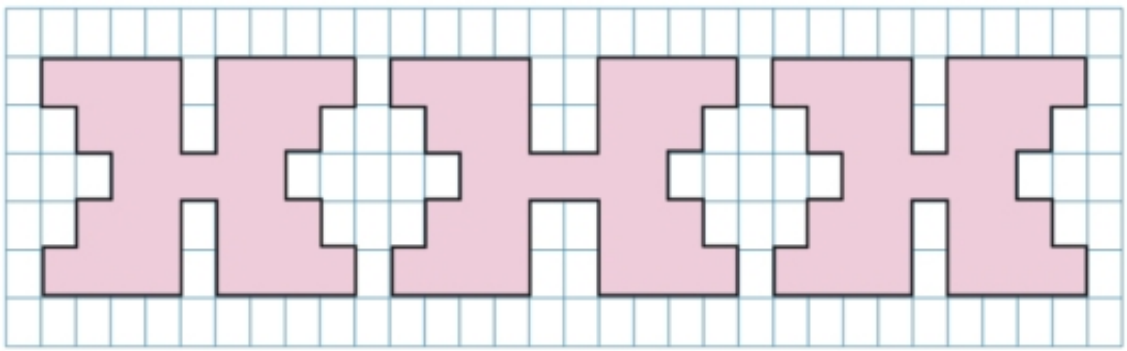


figure (1) figure (2) figure (3)

Using the design shown above,

Complete the following:

If you trace the figure, you will find figures ....., ... have the same size and shape, but the figure ..... is slightly wider.

Two figures are congruent if there is a correspondence between the vertices such that each side and each vertex of one coincides with the corresponding element of the other.

Two line segments are congruent if they have the same length.

Two angles are congruent if they have the same measure.

- The polygon BRAKE is congruent to the polygon CHOKE, the vertices are written in the same order.

Complete:

CH = ... , EK = ...

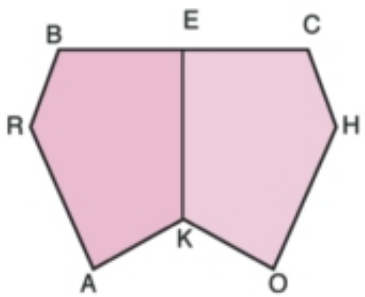
HO = ... , EC = ...

KO = ... , $\overline{KE}$ is a common side

m (∠C) = m (∠ .....), m (∠ OKE) = m (∠ .....)

m (∠H) = m (∠ .....), m (∠ KEC) = m (∠ .....)

m (∠O) = m (∠ .....)



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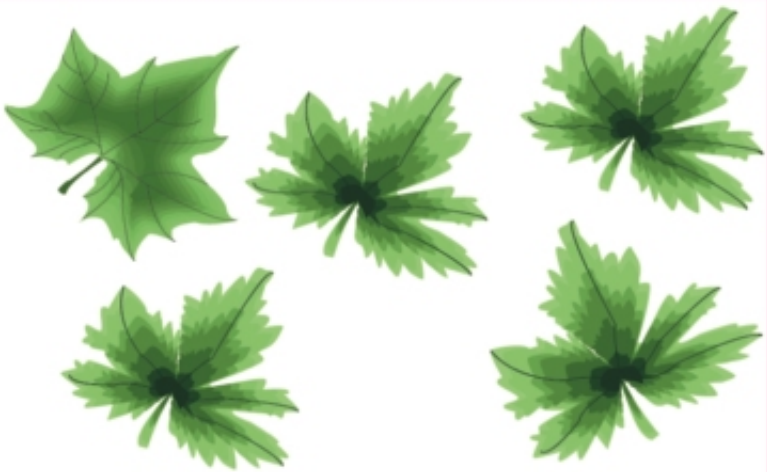
Exercise (4–2)

1 **In the Figure:** there is one leave differs from the others. Which one is different and how?



2 The two pentagons shown are congruent.

Complete

[a] B Corresponds to .....

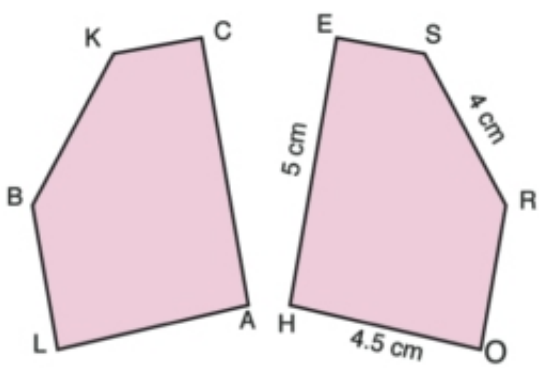
[b] The polygon BLACK is congruent to the polygon.....

[c] KB = ... cm.

[d] m (∠E) = m (∠.....)

[e] CA = ...

[f] m (∠ A) = m (∠.....)



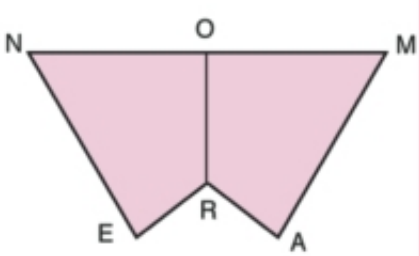
3 In the figure opposite.

OR is the axis of symmetry of N E R A M,

$\overleftrightarrow{O} \in \overline{NM}$

[a] **Complete.**

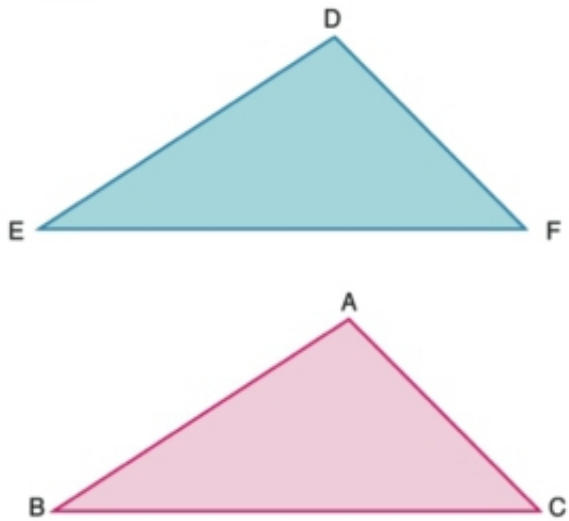
- The quadrilateral NERO is congruent to the quadrilateral .....
- The common side of the two congruent quadrilaterals is .....



[b] In your own words explain why each of the following statements must be true.

1. O is the mid-point of $\overline{NM}$.
2. ∠NOR is congruent to ∠ M O R.
3. $\overline{RO} \perp \overline{NM}$
4. $\overline{OR}$ in the polygon MARO is congruent to $\overline{OR}$ in the polygon NERO.

Lesson 3 Congruent triangles



We know that any triangle has three sides and three angles, which are known as the six elements of the triangle.

Two triangles are congruent, if each of the six elements of one coincides with the corresponding element of the other triangle.

We can usually decide whether two triangles are congruent by placing △ ABC on top of △ DEF to see if they fit (Sometimes we may have to flip one of the triangles over). The vertices like will watch:

A ⟷ D B ⟷ E C ⟷ F

The sides and angles will also match:

Corresponding angles

∠A ⟷ ∠D
∠B ⟷ ∠E
∠C ⟷ ∠F

Corresponding sides

$\overline{AB}$ ⟷ $\overline{DE}$
$\overline{BC}$ ⟷ $\overline{EF}$
$\overline{AC}$ ⟷ $\overline{DF}$

The symbol " ≡ " is used as a short form for " is congruent to " thus △ ABC ≡ △ DEF " is read as triangle ABC is congruent to triangle DEF.

A simple way to remember the correspondence is shown below.

△ ABC ≡ △ DEF

We should not write
△ ABC ≡ △ DEF
We can write △ BCA ≡ △ EFD

△ CAB ≡ △ FDE
⋮ ⋮

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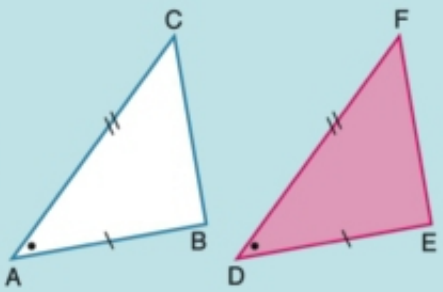
Congruent Triangles

- To test whether two triangles are congruent, or not you don't need to test all the three sides and the three angles.
- Instead of using your geometrical instruments, you can draw and measure figures on your computer to help you discover some rules about congruent triangles.

Activity 1:



* Draw any △ ABC and △ DEF such that:
  m (∠FDE) = m (∠CAB), DE = AB and DF = AC.
  Measure $\overline{BC}$, $\overline{EF}$, ∠ABC and ∠DEF,
  What do you notice?

- Vary △ ABC and △ DEF (Make sure that the above three given conditions are satisfied.)
  Move △DEF and check whether it falls exactly onto △ ABC.
  Is this sufficient so as △ ABC ≡ △ DEF?

- The first case.

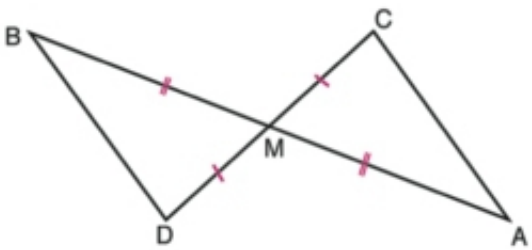
Two sides and the Included Angle' test (SAS).

Two triangles are congruent if two sides and the included angle of one triangle are congruent to the corresponding parts of the other triangle.

Example

In the figure opposite,

$\overline{AB} \cap \overline{CD}$ = {M}, AM = BM, and CM = DM.
Does △ AMC ≡ △ BMD? why?



Solution:

from the figure: AM = BM, CM = DM,
m (∠AMC) = m (∠BMD) v.opp. angles
then △ AMC ≡ △ BMD

Activity 2:

* Draw any △ ABC and DEF such that:

AB = DE

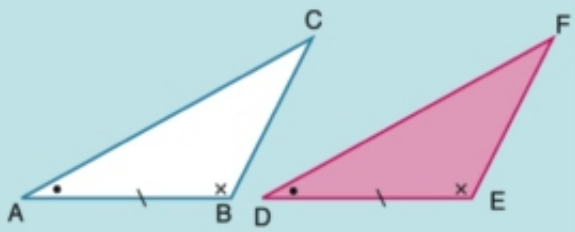
m (∠CAB) = m (∠FDE) and

m (∠CBA) = m (∠FED).

Measure $\overline{AC}$, $\overline{DF}$, $\overline{BC}$, $\overline{EF}$,

∠ACB and ∠DFE.

What do you notice?



- Vary △ ABC and △ DEF without changing the above conditions.

  Move △DEF and check whether it falls exactly onto △ ABC.

- The second case.

Two angles and a corresponding side' test (ASA).

Two triangles are congruent if two angles and the side drawn between their vertices of one triangle are congruent to the corresponding parts of the other triangle.

Dirll

In the figure opposite,

Complete:

△ ABC ≡ .....

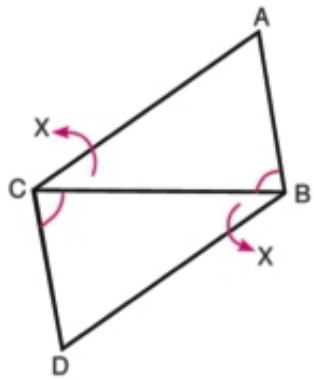
Why?

From the results of congruency:

m (∠A) = m (∠ .....),

AB = ...,

..... = BD



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Activity 3:

* Draw any $\triangle ABC$ and $\triangle DEF$ such that AB = DE, DF = AC and EF = BC. Measure $\angle CAB$, $\angle FDE$, $\angle ABC$, $\angle DEF$, $\angle ACB$ and $\angle DFE$. What do you notice?

- Vary $\triangle$ ABC and $\triangle$ DEF (Make sure that the above three given conditions are satisfied.)

  Move $\triangle DEF$ and check whether it falls exactly onto $\triangle$ ABC.

  Is this sufficient so as $\triangle ABC \equiv \triangle DEF$?

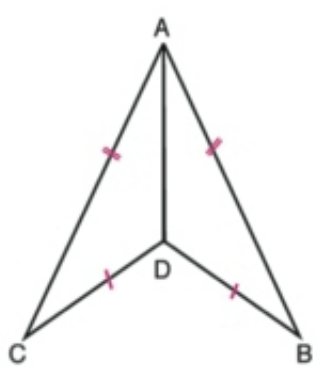
- The third case.

Side-Side-Side' test (SSS).

Two triangles are congruent if each side of one triangle is congruent to the corresponding side of the other triangle.

Example

In the figure opposite,
AB = AC , BD = CD
verify that: $\overrightarrow{AD}$ bisects $\angle A$



Solution:
$\triangle ABD \equiv \triangle ACD$ (sss)
From the results of congruency
then m ($\angle BAD$) = m ($\angle CAD$)
i.e $\overrightarrow{AD}$ bisects $\angle A$

Activity 4:

* Draw any $\triangle ABC$ right-angled at B and $\triangle FDE$, such that $m(\angle D) = m(\angle B)$, $FE = CA$ and $ED = BC$. Measure $\overline{AB}$, $\overline{FD}$, $\angle CAB$, $\angle EFD$, $\angle ACB$ and $\angle FED$.

What do you notice?

- Vary $\triangle ABC$ and $\triangle DEF$ without changing the above conditions.

  Move $\triangle DEF$ and check whether it falls exactly onto $\triangle ABC$.

  Is this sufficient so as $\triangle ABC \equiv \triangle DEF$?

- The forth case.

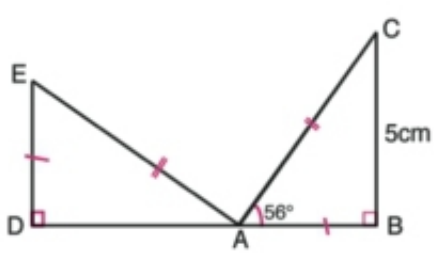
Right angle, Hypotenuse and side' test (RHS)

Two right- angled triangles are congruent if the hypotenuse and a side of one triangle are congruent to the Corresponding parts of the other triangle.

Example

In the figure opposite,

Study the case of congruency then deduce: $m(\angle AED)$, length of $\overline{AD}$



Solution:

$\triangle ABC \equiv \triangle EDA$ (RHS)

From the results of congruency

then $m(\angle AED) = m(\angle CAB) = 56°$

$AD = CB = 5$ cm

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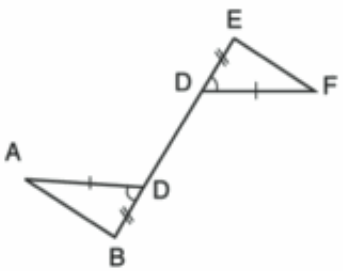
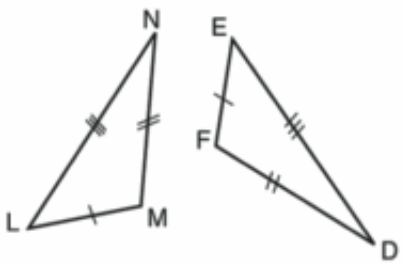
Dirll

In the figures below, the similar signs denote the congruency of the elements marked by these signs.
Mention the pairs of congruent and non congruent triangles (give reason).

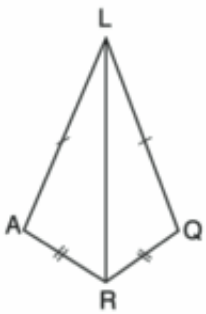
[1]



[2]

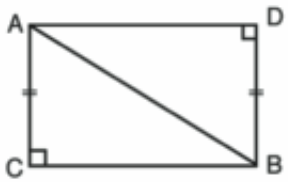


[3]

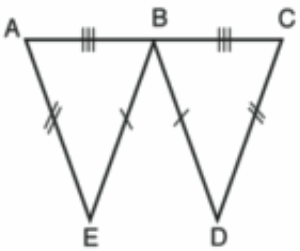


[4]

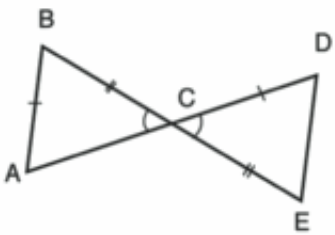
[5]



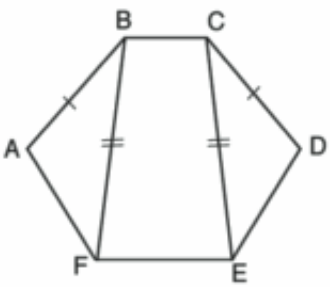
[6]



[7]



[8]

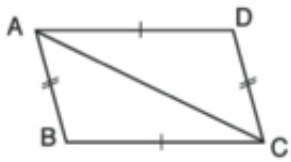


Exercise (4–3)

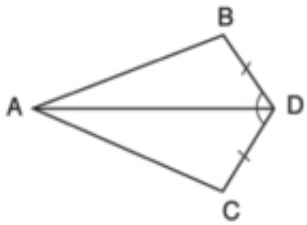
1 The similar signs denote the congruency of the elements marked by these signs.

- Are the triangles congruent?
- Write a correct statement of congruence and state the test used.

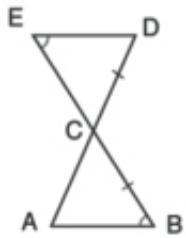
[a]



[b]



[c]



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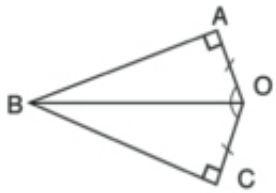

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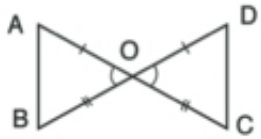
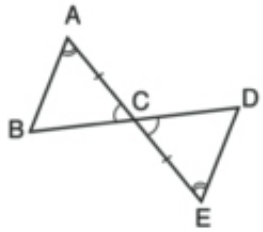
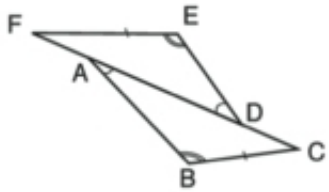


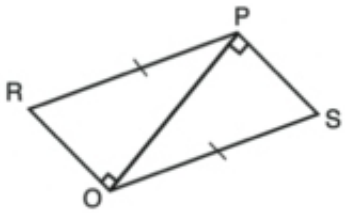
[f]



[g]

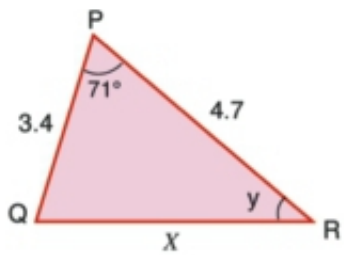


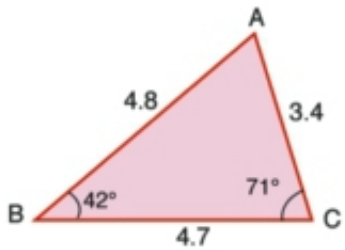
[h]



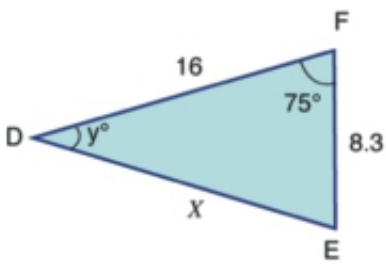
2 Study these figures and calculate the values of x and y.

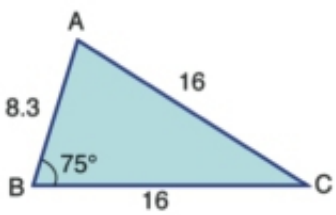
[a]



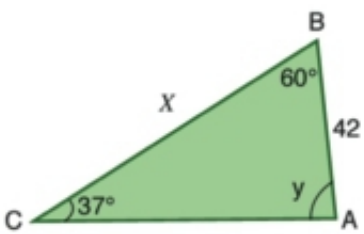


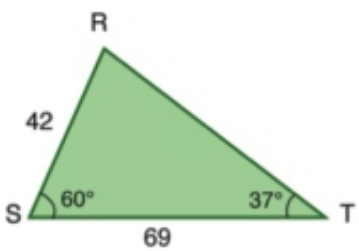
[b]



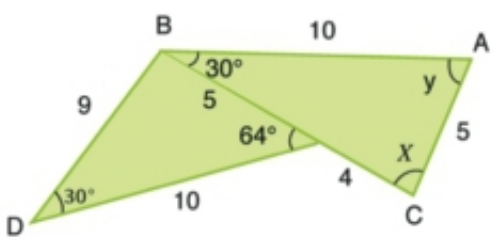


[c]

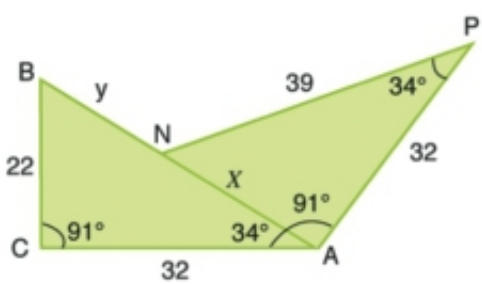




[d]

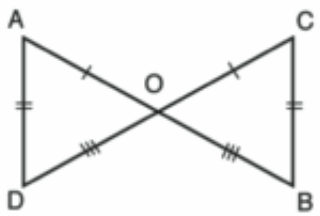


[e]

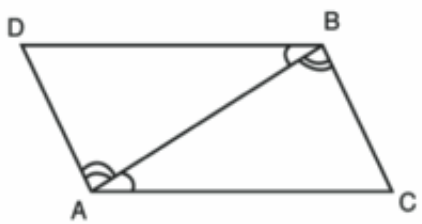


3 The similar signs denote the congruency of the elements marked by these signs. Find the two congruent triangles, give reasons, and write down the results of congruence.

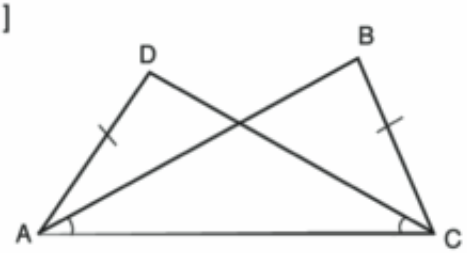
[a]



[b]



[c]



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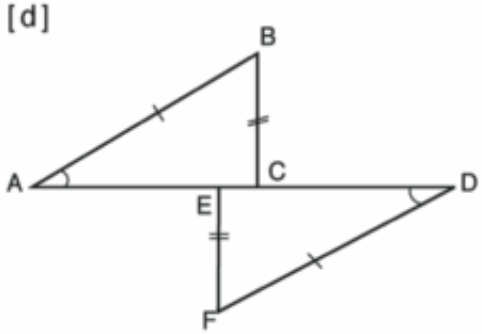
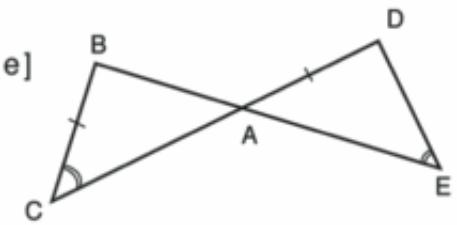
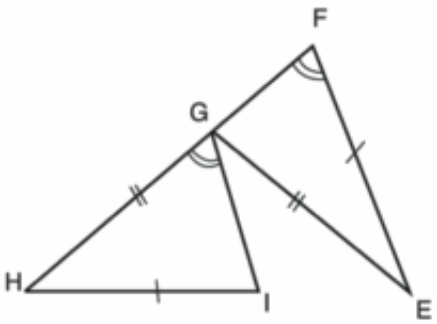


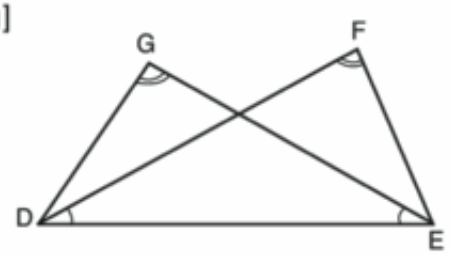
[e]



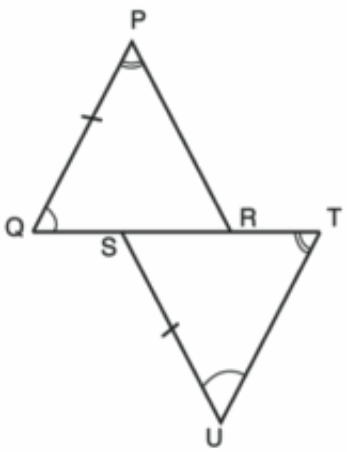
[f]



[g]



[h]



4 Study the data for $\triangle ABC$ and $\triangle XPG$. Are these triangles congruent? Write, if applicable, a correct statement of congruence and state the test used.

[a] $AB = PX$, $AC = XG$, $\angle A \equiv \angle X$

[b] $BC = PG$, $BA = XP$, $\angle B \equiv \angle G$

[c] $AB = PG$, $BC = PX$, $AC = XG$

[d] $AB = XP$, $CA = GX$, $\angle B \equiv \angle P$

[e] $\angle B \equiv \angle G$, $\angle C \equiv \angle X$, $BC = XG$

[f] $\angle A \equiv \angle X$, $\angle B \equiv \angle P$, $AC = PG$

5 Mark (✓) for the correct statement:

[a] Two triangles are congruent if the lengths of sides of one triangle are equal to the corresponding parts of the other.

[b] Two triangles are congruent if the measures of the angles of one triangle are equal to the measures of the corresponding parts of the other.

[c] Two right- angled triangles are congruent if the lengths of two sides of one triangle are equal to the corresponding parts of the other triangle.

[d] Two right- angled triangles are congruent if the length of the hypotenuse and the measure of an angle differs from the right angle are equal to the corresponding parts of the other triangle.

[e] Two right- angled triangles are congruent if the length of the hypotenuse and the length of a side of one triangle are equal to the corresponding parts of the other triangle.

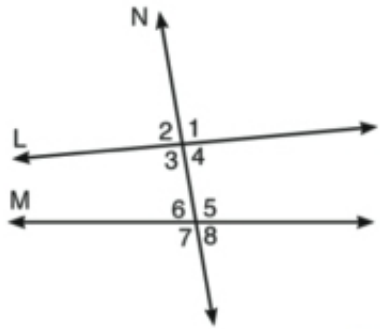
6 [a] Use a protractor to draw a triangle whose angles have measure 50°, 60°, and 70°.

[b] Can you draw another triangle whose angles have measures 50°, 60°, and 70° but which is not congruent to the first triangle?

Lesson 4

Parallelism

Draw two straight lines L and M, then draw a transversal N (a line that intersect them both).
Pairs of alternate, corresponding and interior angles are formed.



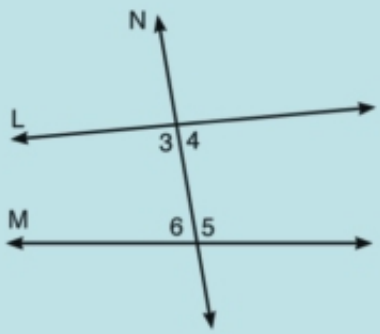
Activities

1 Complete:

∠ 3 and ∠ 5 are called alternate angles

∠ ..... and ∠ ..... are called alternate angles

In case of L is parallel to M, Notice the relation between the alternate angles.

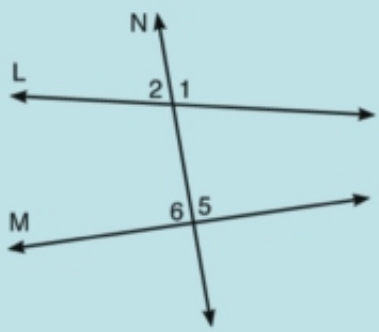


2 ∠ 1 and ∠ 5 are called corresponding angles.

∠.... and ∠..... are called corresponding angles.

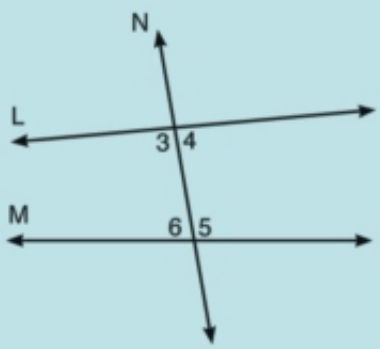
Determine two more pairs of corresponding angles.

In case of L is parallel to M, notice the relation between the corresponding angles.



3 ∠ 4 and ∠ 5 are called interior angles on one side of the transversal, ∠ ..... and ∠ ..... are called interior angles on one side of the transversal.

In case of L is parallel to M, Notice the sum of two interior angles on one side of the transversal.



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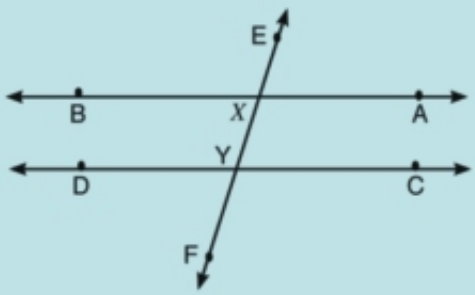
Use your computer or geometrical instruments to carryout the following activities.

Activity 1

From a point C which is not on $\overleftrightarrow{AB}$,

draw $\overleftrightarrow{CD}$ // $\overleftrightarrow{AB}$, draw $\overleftrightarrow{EF}$ a transversal to intersect $\overleftrightarrow{CD}$ and $\overleftrightarrow{AB}$ at X and Y respectively, determine:



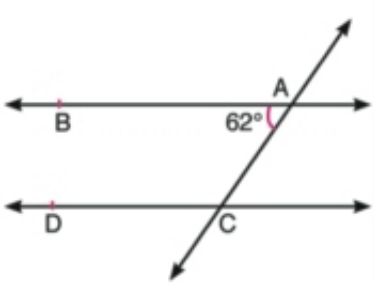
- The measures of two alternate angles.
- The measures of two corresponding angles.
- The measures of two interior angles on one side of the transversal, then add them vary the position of the transversal $\overleftrightarrow{EF}$. What do you notice?

- **If a straight line intersects two parallel straight lines, then:**
  - **Every two alternate angles are equal in measure.**
  - **Every two corresponding angles are equal in measure.**
  - **Every two interior angles on one side of the transversal are supplementary.**

Dirll

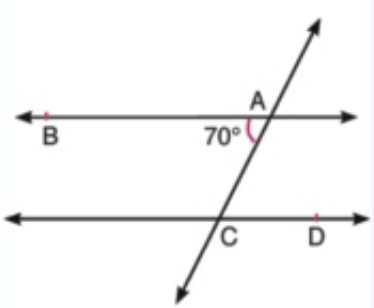
In each of the following figures, If $\overleftrightarrow{AB}$ // $\overleftrightarrow{CD}$, then complete:

[1]



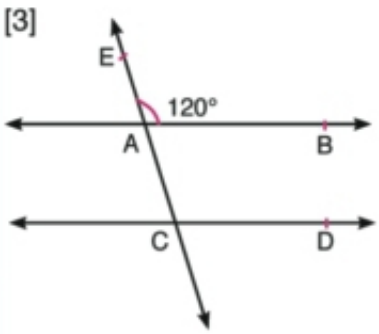
m (∠ACD) = ...° – ..... °
= .....°

[2]



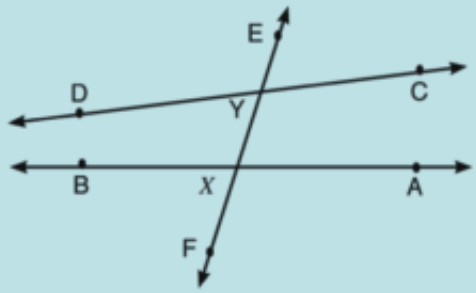
m (∠ACD) = m (∠.....)
= .....°

[3]



m (∠ACD) = m (∠.....)
= .....°

Activity 2



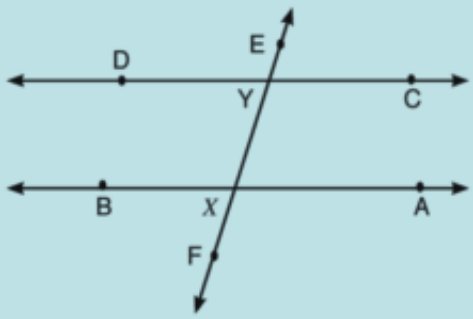
[a] Draw $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$, then draw the transversal $\overleftrightarrow{EF}$ to intersect them at X and Y respectively, determine:

The measures of the two alternate angles CYX and BXY

Rotate $\overleftrightarrow{CD}$ about Y until m (∠CYX) = m (∠BXY). Test whether $\overleftrightarrow{CD}$ is parallel to $\overleftrightarrow{AB}$ by drawing $\overleftrightarrow{MN}$ passes through Y and is parallel to $\overleftrightarrow{AB}$.

Does $\overleftrightarrow{MN}$ coincide with $\overleftrightarrow{CD}$?

Determine once again the measure of the alternate angles CYX and BXY



[b] Carryout similar activities as in [a] about:

[1] corresponding angles.

[2] interior angles on the same side of the transversal.

What do you notice?

- **Two straight lines in a plane are parallel if they are cut by a transversal in such a way that:**
  - **The alternate angles are equal in measure.**
  - **The corresponding angles are equal in measure.**
  - **The interior angles on one side of the transversal are supplementary.**

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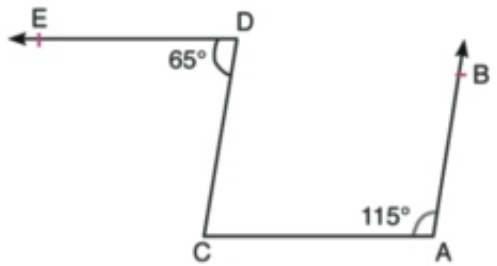
Example

In the figure opposite,

If $\overrightarrow{AB} \parallel \overrightarrow{CD}$,

Does $\overrightarrow{AC} \parallel \overrightarrow{DE}$? why?



Solution:

m (∠C) = 180° – 115° = 65° because .....

i.e m (∠C) = m (∠D) = 65°

then $\overrightarrow{AC} \parallel \overrightarrow{DE}$

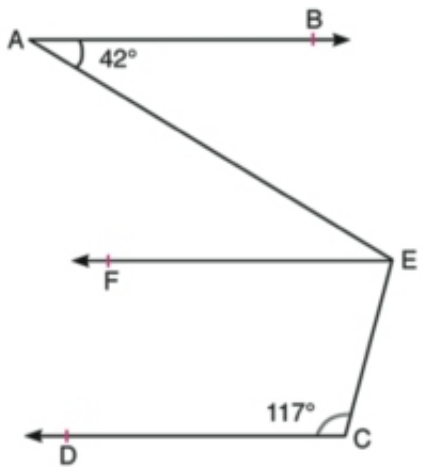
Drill

In the figure opposite,

$\overrightarrow{AB} \parallel \overrightarrow{CD}$, $\overrightarrow{EF} \parallel \overrightarrow{CD}$,

m (∠A) = 42°, and m (∠C) = 117°

Determine m (∠AEC)



Solution:

m (∠AEC) = m (∠A) + m (∠ .....)

= ..... ° + ...°

= .....°

Because .....

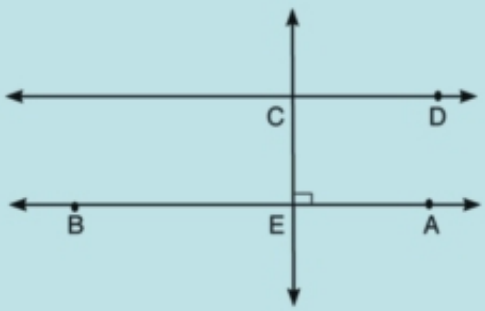
Activity 3

Draw a straight line AB and mark a point C which is not on $\overleftrightarrow{AB}$, draw $\overleftrightarrow{CD}$ // $\overleftrightarrow{AB}$ and a straight line through C perpendicular to $\overleftrightarrow{AB}$ intersecting $\overleftrightarrow{AB}$ at E. Measure ∠DCE.

Name the relationship between $\overleftrightarrow{CD}$ and $\overleftrightarrow{CE}$

vary the position of $\overleftrightarrow{CE}$ and $\overleftrightarrow{CD}$.

What do you notice?



- **A straight line that is perpendicular to one of two parallel lines is also perpendicular to the other.**
- **If each one of two straight lines is perpendicular to a third line in a plane, then the two straight lines are parallel.**

Activity 4

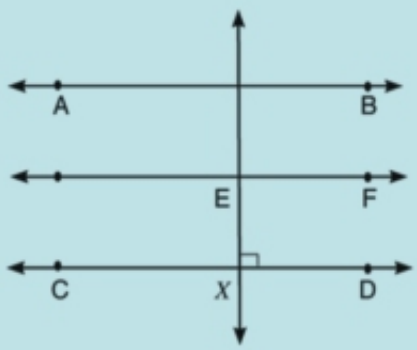
Draw $\overleftrightarrow{AB}$ // $\overleftrightarrow{CD}$, then draw $\overleftrightarrow{EF}$ // $\overleftrightarrow{AB}$, then draw $\overleftrightarrow{EX}$ ⊥ $\overleftrightarrow{CD}$ and intersects it at X.

Measure ∠FEX

Is $\overleftrightarrow{EF}$ also parallel to $\overleftrightarrow{CD}$? Give your reasons

Vary the position of $\overleftrightarrow{EX}$ and $\overleftrightarrow{CD}$.

What do you notice?



- **If two straight lines are parallel to a third straight line, then these two straight lines are parallel to each other.**

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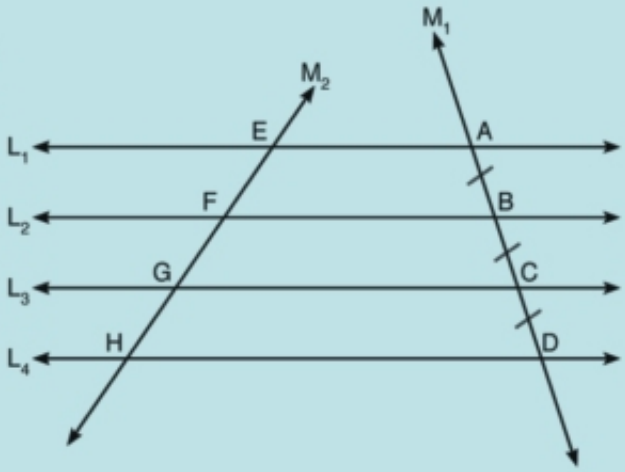
Activity 5

Draw several parallel lines L_1, L_2, L_3, L_4 then draw the transversal M_1, intersect them at A, B, C, and D respectively where AB = BC = CD. Draw the transversal M_2 to intersect them at E, F, G, and H

Does EF = FG = GH?

What do you notice?



Vary the position of the transversal M_2, what do you notice?

- **If Parallel straight lines divide a straight line into segments of equal lengths, then they divide any other straight line into segments of equal lengths**

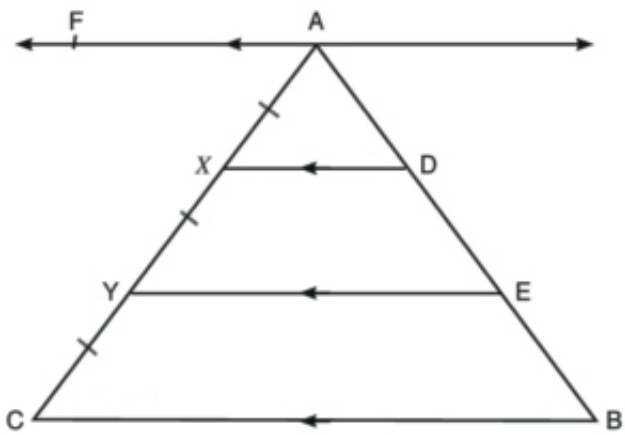
Drill

In the figure opposite,

$\overleftrightarrow{AF}$ // $\overleftrightarrow{DX}$, $\overleftrightarrow{EY}$ // $\overleftrightarrow{BC}$,

AX = XY = YC and AB = 12 cm

Find the length of $\overline{BE}$



Solution:

$\overleftrightarrow{AF}$ // ..... // ..... // ..... ,

AX = ... = ...

Then AD = DE = EB

i.e BE = $\frac{1}{3}$ AB = 4 cm

Exercise (4–4):

1 Complete:

[a] A straight line that is perpendicular to one of two parallel lines is also ..... to the other.

[b] A straight line that is parallel to one two parallel lines is also ..... to the other.

[c] When a transversal cuts two parallel lines,

[1] The alternate angles are .....

[2] THe corresponding angles are .....

[3] The interior angles on the same side of the transversal are .....

[d] Two straight lines in a plane are parallel if they are cut by a transversal in such a wayh that

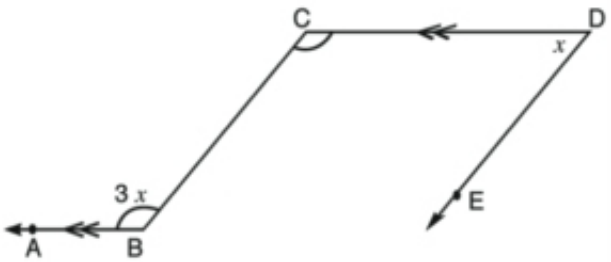
[1] The ..... angles are equal, or

[2] The ..... angles are equal, or

[3] The ..... angles on the same side of the transversal are supplementary.

[e] If two straight lines intersect, then the measure of each two vertically opposite angles are.....

[f] In this figure, if $\overline{CD}$ // $\overrightarrow{BA}$ and $\overrightarrow{DE}$ // $\overline{CB}$. then x = ...°

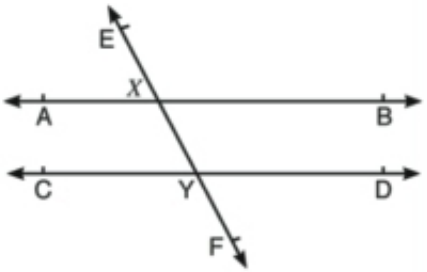


2 In this figure:

$\overleftrightarrow{AB}$ // $\overleftrightarrow{CD}$, and $\overleftrightarrow{EF}$ is a transversal

[a] What angles are equal in measure to ∠EXB?

[b] What angles are equal in measure to ∠XYC?



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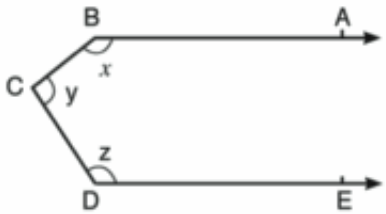
3 **In this figure.**

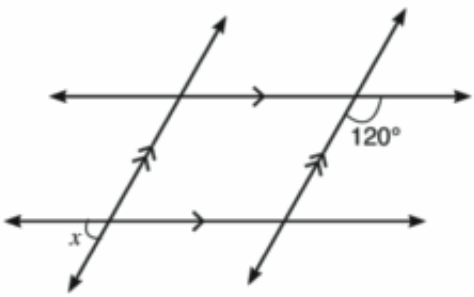
$\overrightarrow{BA}$ // $\overrightarrow{DE}$ calculate: $x + y + z$.

(Hint: Draw a line through C parallel to $\overrightarrow{BA}$).

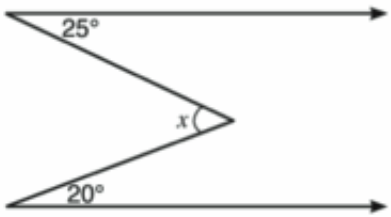


4 **Find the value of x in each figure:**

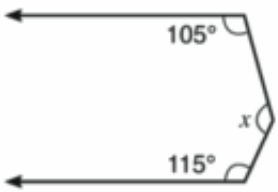
[a]



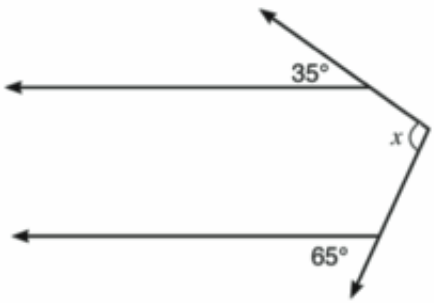
[d]



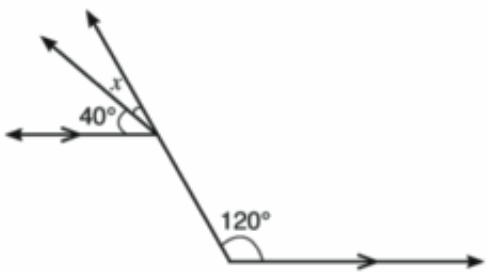
[b]



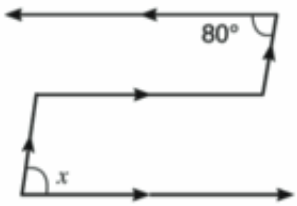
[e]



[c]



[f]

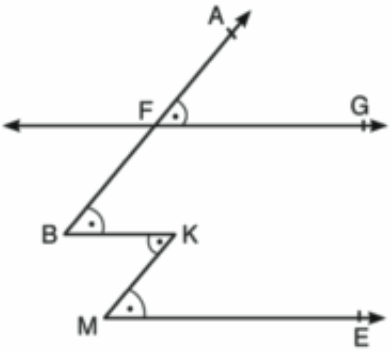


5 **In this figure.**

m (∠AFG) = m (∠B) = m (∠K) = m (∠M)

write the four pairs of parallel lines.

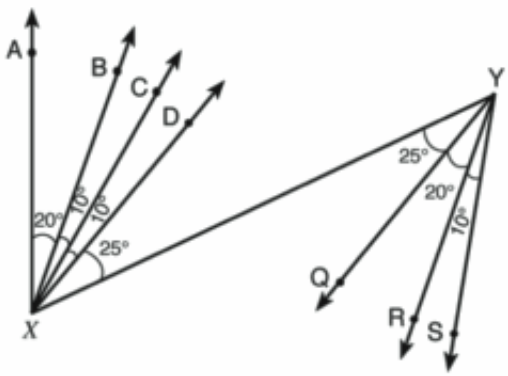
Give your reasons.



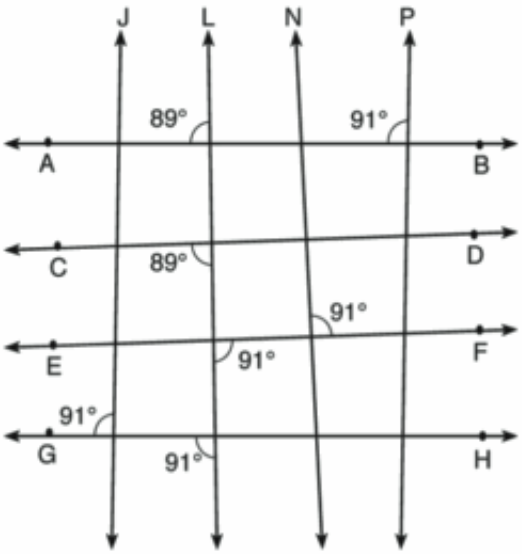
6 **In the these figures:**

Name the pairs of parallel lines in each Figure:

[a]



[b]



Lesson 5 Geometric constructions

1 Constructing the bisector of a given angle

Given: ∠ABC is a given angle

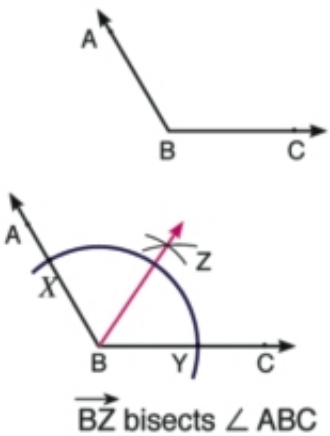
construction: The bisector of ∠ABC

Procedure:

1. With B as a centre and a suitable radius, draw an arc that intersects $\overrightarrow{BA}$ at X and $\overrightarrow{BC}$ at Y.
2. With each of X and Y as centre and a suitable radius, draw two arcs which intersect at Z.
3. Draw $\overrightarrow{BZ}$

Complete:

$\overrightarrow{BZ}$ is the ..... of symmetry of ∠ABC.



2 Constructing a perpendicular from a point outside a straight line

Given: $\overleftrightarrow{AB}$ is a given straight line, P ∉ $\overleftrightarrow{AB}$

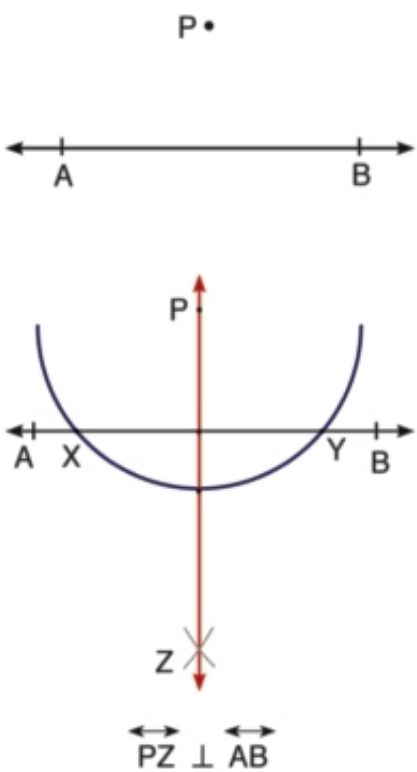
Construction: The perpendicular to $\overleftrightarrow{AB}$ from P.

Procedure:

1. With P as a centre and a suitable radius , draw an arc which intersects $\overleftrightarrow{AB}$ at points X and Y.
2. With each of X and Y as centres and a suitable radius, draw arcs which intersect at a point Z
3. Draw $\overleftrightarrow{PZ}$.

Complete:

$\overleftrightarrow{PZ}$ is the .... of symmetry of $\overline{XY}$.

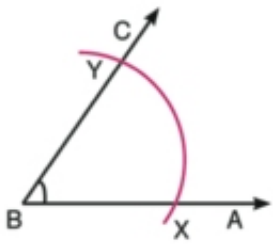


3 Constructing an angle to be congruent to a given angle:

Given: ∠ABC is a given angle

construction: drawing ∠DEF congruent to ∠ABC

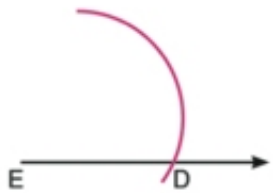
"without using a protractor"



Procedure:

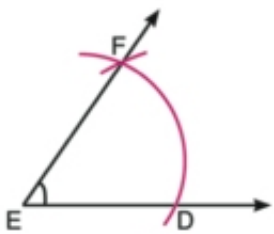
1. Draw a ray with start point E to represent one of the sides of the required angle.

2. Using the compasses, with B as a centre, and with suitable radius draw an arc to cut $\overrightarrow{BA}$ and $\overrightarrow{BC}$ at X and Y respectively and with E as a centre, and with the same radius, draw an arc to cut the ray at D.



3. With X as a centre and with radius equals XY , then with D as a centre and with the same radius above, draw an arc to cut the first arc at F.

4. Draw $\overrightarrow{EF}$, then ∠DEF is congruent to ∠ .....



4 Activity : Bisecting a line segment

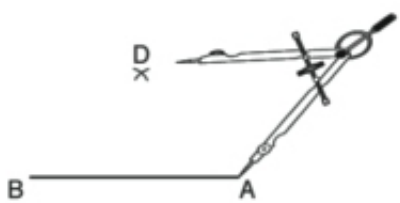
Given: $\overline{AB}$ is defined line segment

Required: bisecting $\overline{AB}$

Steps:

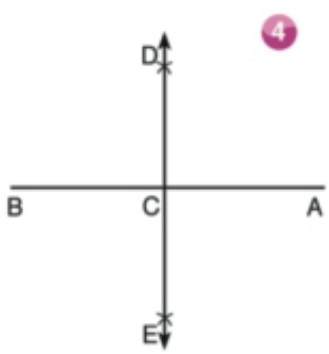
1. Draw the line segment $\overline{AB}$.

2. Place the sharp point of a compass at point A, and adjust your compass to a length of $\overline{AB}$ then draw 2 arcs at 2 different directions from $\overline{AB}$.



3. Place the sharp point of the compass at point B, and with the same length, draw 2 arcs at the different directions of $\overline{AB}$ such that they intersect with the previous two arcs at points D, E.

4. Draw $\overline{DE}$ to intersect $\overline{AB}$ at C, then, the point C becomes the midpoint of $\overline{AB}$.



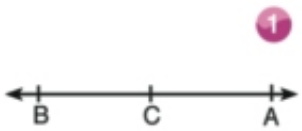
5 Drawing a perpendicular on a straight line that Passes by a point which belongs to that straight line.

Given: $\overleftrightarrow{AB}$ is a defined straight line $C \in \overline{AB}$

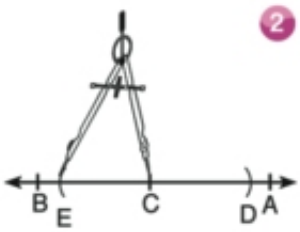
Required: Drawing a Perpendicular line on $\overleftrightarrow{AB}$ from point C

Steps:

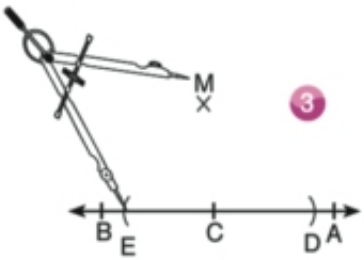
1 Draw $\overleftrightarrow{AB}$ and label $\overline{AB}$



2 Place the sharp point of a compass at C and adjust it to a suitable length then draw 2 arcs at 2 different directions from C Such that those arcs intersect $\overleftrightarrow{AB}$ at the two points D and E.



3 Place the sharp point of a compass at both D and E and adjust it to a suitable length which is more than $\overline{CD}$, then draw two arcs that intersect at point M.



4 Draw $\overline{MC}$, then $\overleftrightarrow{MC} \perp \overleftrightarrow{AB}$

Drawing the scalene acute angled trianle ABC, and draw an axis of symmetry for each side "don't erase the arcs" Do the axes of symmetry intersect in on point?.

Discuss:

1. If DEF is an obtuse angled triangle at E. Where do the axes of symmetry for its sides intersect?.
2. If XYZ is aright angled triangle at Y. Where do the axes of symmetry for its sides intersect?.
3. Measure the lengths of the line segments that connect the intersection point of the axes of symmetry with the vertices of the triangle in each case? What do you observe?.

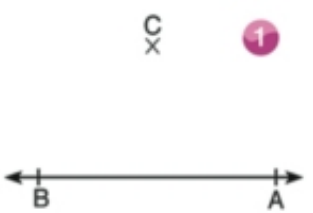
Two sharp point compass is used to measure the distance between two point.

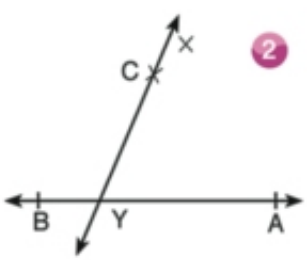
6 Activity:

Drawing a straight line from a given point parallel to a given straight line.

Given: $\overleftrightarrow{AB}$ is a given straight line, $C \notin \overleftrightarrow{AB}$

Required: Draw a straight line from point C parallel to $\overleftrightarrow{AB}$

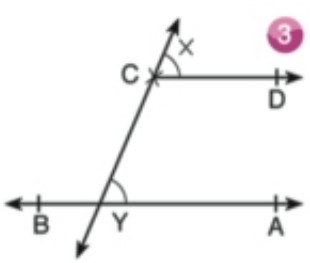




Steps:

1. Draw $\overleftrightarrow{AB}$, $C \notin \overleftrightarrow{AB}$
2. Draw $\overleftrightarrow{XY}$ crosses through the point C and intersects $\overleftrightarrow{AB}$ at Y.
3. At point C draw the angle XCD corresponding to ∠AYX such that ∠XCD ≡ ∠XYA as shown in the previous activity.

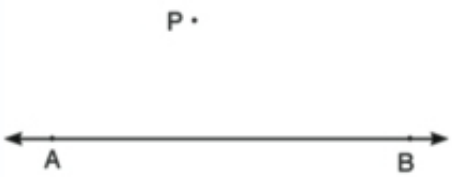
   Then $\overleftrightarrow{CD} \parallel \overleftrightarrow{AB}$



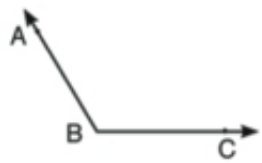
Exercise (4–5)

1 Do the indicated construction (Don't remove the arcs)

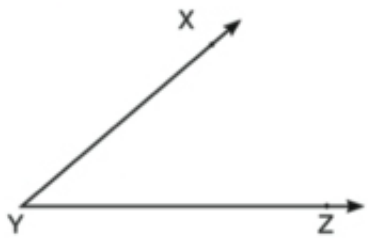
[a] The perpendicular to AB from P



[b] The bisector of ∠ ABC



[c] The bisector of ∠ XYZ



[d] The axis of symmetry of $\overline{AB}$

2 [a] Draw any acute angled triangle. Bisect each of the three angles.

[b] Draw any obtuse angled triangle. Bisect each of the three angles.

[c] What do you notice about the points of intersection of the bisectors in parts (a) and (b)?

3 [a] Draw any acute angle triangle. construct the perpendicular bisector of each side.

[b] Do the perpendicular bisectors intersect in one point?

[c] Repeat parts (a) and (b) using an obtuse angled triangle.

4 [a] Draw any acute angled triangle. Construct the three altitudes.

[b] Do the straight lines that contain the altitudes intersect in one point?

[c] Repeat parts (a) and (b) using an obtuse angled triangles.

5 Use the ruler and protractor to draw the traingle ABC in which AB = 5 cm, BC = 6 cm, and CA = 7 cm. D ∈ $\overrightarrow{CB}$

[a] draw ∠DBE congruent to ∠A

[b] Complete: m (∠ABE) = m (∠.....)

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6 Draw $\overline{BC}$ in a suitable length, using a compass and the unscaled ruler, bisect $\overline{BC}$ at D and from D draw the $\overline{DA}$ perpendicular to $\overline{BC}$, then draw $\overline{AB}$ and $\overline{AC}$. Compare the lengths of $\overline{AB}$ and $\overline{AC}$ using the compass. What do you observe?.

7 Draw the isosceles triangle ABC in which AB = AC using the compass, bisect $\overline{BC}$ at D. Draw $\overline{AD}$ and prove that $\overline{AD} \perp \overline{BC}$.

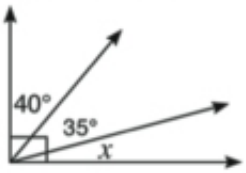
8 Draw the right angled triangle XYZ at Y using compass and ruler only. Bisect $\overline{XZ}$ at M. Draw $\overline{YM}$. Are MX = MY = MZ? Draw other right angled triangles and repeat the same construction. Are MX = MY = MZ?.

UNIT TEST

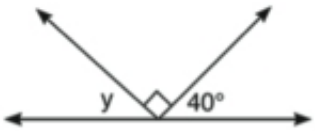
Answer all the questions

1 **Complete:**

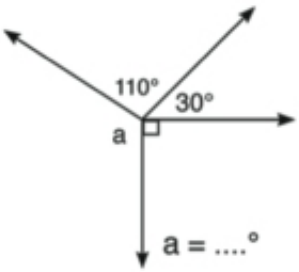
[a] Calculate the measure of the unknown angle in each of the following:



x = ...°

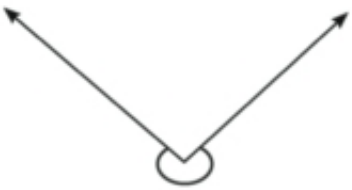


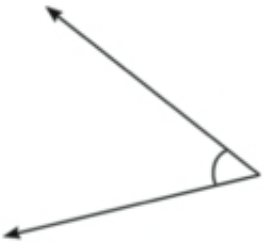
y = ...°



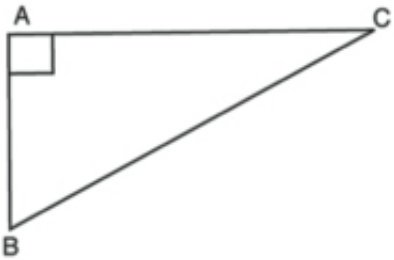
a = ...°

[b] For each of the following angles, write the closest measure from the following: 80°, 120°, 240°.





[c] Write the line segment which represents the hypotenuse in the triangle .....



2 [a] Using a ruler and the compass, draw a triangle ABC in which AB = AC = 7 cm, BC= 6 cm. Bisect ∠B and ∠C by two bisectors which intersect at M. Is MB = MC?

[b] Using a ruler and a compasses, draw the triangle ABC in which AB = AC = 5 cm, BC= 6 cm, then draw $\overline{AD} \perp \overline{BC}$ Where $\overline{AD} \cap \overline{BC} = \{D\}$

Measure the length of $\overline{AD}$. (Don't remove the arcs).

3 Using the ruler and the compasses draw Δ ABC and bisect each of $\overline{AB}$, $\overline{AC}$ at D,E respectively. Draw $\overline{DE}$.

[a] Using the compasses, measure $\overline{DE}$ and satisfies that BC = 2DE.

[b] Is ∠ABC ≡ ∠ADE? Does $\overline{DE}$ // $\overline{BC}$?.

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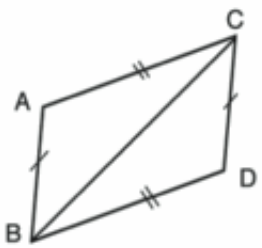
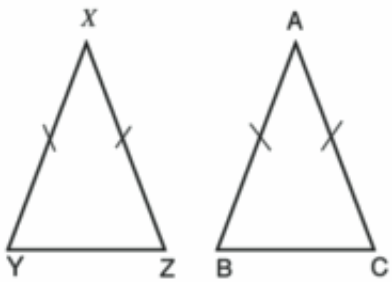
4 Draw Δ ABC in which AB = 4 cm, BC = 5cm and AC = 6cm. Construct the perpendicular bisectors of Triangle sides. What do you notice?.

5 **In the following figures, Find the two congruent triangles, give reasons, and write down the results of congruence**:

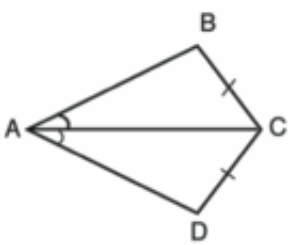
[a]



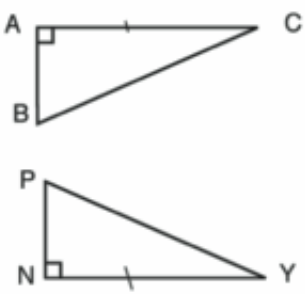
[d]



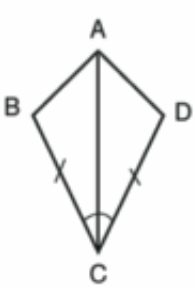
[b]



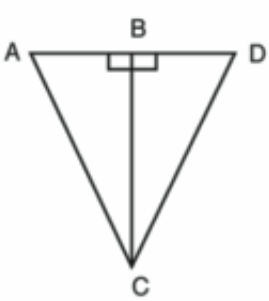
[e]



[c]

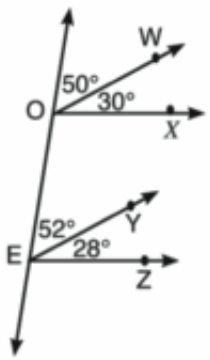


[f]

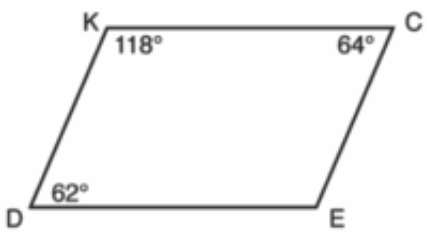


6 State which segments are parallel in each figure?

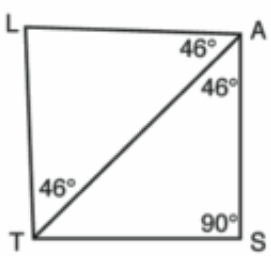
[a]



[b]



[c]



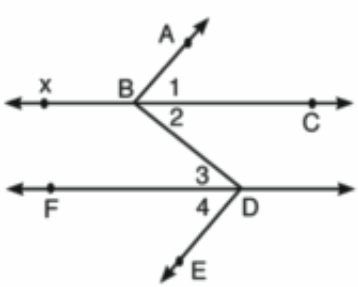
7 In the figure opposite:

$m(\angle 1) = m(\angle 4)$,

$\overleftrightarrow{BC} \parallel \overleftrightarrow{FD}$

Does $\overrightarrow{BA} \parallel \overrightarrow{DF}$?

give reason



Algebra and statistics
General Exercises

Exercise (1)

1 Complete each of the following :

[1] The multiplicative inverse of the number $\frac{-9}{8}$ is .....

[2] If $\frac{a}{b} = \frac{2}{3}$, then $\frac{3a}{2b}$ = ...

[3] The remainder of subtracting $\left(\frac{1}{5}\right)$ from $\left(-\frac{2}{5}\right)$ equals .....

[4] The simplest from of the expression : $\frac{3}{4} \times \left(\frac{1}{2} - \frac{1}{3}\right)$ is .....

[5] The rational number half way between $-\frac{5}{2}$ and $-\frac{3}{2}$ is .....

2 Choose the correct answer from those given :

[1] If $\frac{15}{\chi} = \frac{-3}{4}$, then χ = ...

(a) – 20 (b) – 5 (c) 5 (d) 20

[2] The number = $\frac{-9}{-7}$ is the additive inverse of the number : .....

(a) $\frac{-9}{7}$ (b) $\frac{-7}{9}$ (c) $\frac{7}{9}$ (d) $\frac{9}{7}$

[3] If $5\chi - 3y = 0$, then $\chi : y$ = ...

(a) 5 : 3 (b) 3 : 5 (c) – 5 : 3 (d) – 3 : 5

[4] If $a \times \frac{b}{3} = \frac{a}{3}$, then b equals : .....

(a) – a (b)1 (c) $\frac{a}{3}$ (d) a

[5] The number $\frac{5}{3}$ > .....

(a) $\frac{10}{3}$ (b) $\frac{25}{9}$ (c) $\frac{10}{6}$ (d) $\frac{3}{5}$

3 Answer the following :

[1] Complete in the same pattern :

$7 , 6\frac{1}{3} , 5\frac{2}{3} , 5 , 4\frac{1}{3}$, ... , ... , ... $1\frac{2}{3}$

[2] Use the property of distribution to calculate the value of :

$\frac{6}{37} \times 7 + \frac{6}{37} \times 5 + \frac{6}{37} \times (-11)$

[3] If $-3\frac{4}{7} \times \chi = -3\frac{4}{7}$, then find the value of χ

[4]If $\chi = \frac{3}{2}$, $y = -\frac{1}{4}$ and $Z = -2$, then find the numerical value of : $\chi - (Z \div y)$

[5] The ratio between exports and imports in one year is 3 : 4 , If exports increased by 20 % and imports decreased by 10% in the next year. find the ratio between exports and imports in the last year.

Exercise (2)

1 Complete the following :

[1] The additive inverse of the number $\frac{7}{25} \times (-5)^2$ is .....

[2] $3 \times$ ..... $= 1$

[3] If $\frac{\chi - 5}{\chi - 7} = 0$, then $\chi =$ .....

[4] The rational number which hasn't a multiplicative inveree is .....

[5] If $\frac{\chi}{2} + \frac{5}{7} = \frac{10}{35}$, then 2χ equals .....

2 Choose the correct answer from those given :

[1] $\frac{5}{8} - \frac{1}{4} >$

(a) 1 (b) $\frac{3}{4}$ (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

[2] The number of Integers lying between $\frac{7}{4}$, $\frac{11}{8}$ is .....

(a) Zero (b) 1 (c) 2 (d) infinite number

[3] The rational number $\frac{\chi}{-5}$ is negative if $\chi =$

(a) > Zero (b) < Zero (c) ≤ Zero (d) = Zero

[4] The remainders of dividing four consecutive integers by the number 3 respectively may be :

(a) 1 , 2 , 3 , 1 (b) 1 , 2 , 3 , 4 (c) 0 , 1 , 2 , 3 (d) 0 , 1 , 2 , 0

3 Answer the following questions :

[1] Complete in the same pattern :

$\frac{1}{1}$, $\frac{2}{2}$, $\frac{3}{4}$, $\frac{4}{8}$, $\frac{5}{16}$, ... , ... , $\frac{8}{128}$

[2] If $\chi = -\frac{1}{3}$, $y = \frac{3}{4}$ and $Z = -3$ then find the value of :

first : $(\chi + y) \div Z$ second : $\chi y + y z$

[3] If the two rational numbers $\frac{3\chi}{4}$ and $\frac{2}{3}$ are equal then find the value of χ.

[4] Find the value of the expression : $\frac{1}{3} \times \left(-\frac{1}{3}\right) \div \left(-\frac{1}{3}\right) \times \frac{1}{5}$

[5] Find the rational number that lies two third of the way from $\frac{4}{7}$ to $1\frac{3}{4}$ from the smallest.

Exercise (3)

1 Complete the following :

[1] $\frac{3}{5} + \frac{7}{10} + (-\frac{1}{2}) =$ .....

[2] $\frac{4}{25} = \frac{2}{5} \times \frac{.....}{35}$

[3] $\left(\frac{2}{7} + \frac{3}{5}\right)$ is the multiplicative inverse of the rational number .....

[4] The rational number that lies half way between $\frac{3}{7}$ and $\frac{6}{7}$ is .....

[5] $\frac{2}{3}\left(2 + \frac{1}{2}\right) = \frac{2}{3} \times 2 + \frac{2}{3} \times$ .....

2 Choose the correct answer from those given :

[1] If $\frac{7}{\chi + 5}$ is a rational number , them $\chi \neq$ .....

(a) -5 (b) 0 (c) 2 (d) 10

[2] If $\chi = 3$, $y = 4$ and $Z = 6$, then $\frac{\chi}{y} - \frac{z}{\chi}$ equals :

(a) $-1\frac{1}{4}$ (b) $\frac{1}{4}$ (c) $\frac{5}{4}$ (d) $1\frac{3}{4}$

[3] The remainder of subtracting $\frac{3}{7}$ from $\frac{9}{21}$ equals :

(a) zero (b) $\frac{6}{21}$ (c) $\frac{6}{14}$ (d) $\frac{12}{28}$

[4] If $3a = 27$ and $ab = 1$, then $b =$

(a) $\frac{1}{9}$ (b) $\frac{1}{5}$ (c) 5 (d) 9

[5] which of the following relations is true , where $\chi = 3$, $y = 5$, $z = 15$

(a) $y = \chi z$ (b) $\chi = yz$ (c) $y = \frac{z}{\chi}$ (d) $z = \frac{y}{\chi}$

3 Answer the following questions :

[1] Arrange the following rational numbers in a descending order :

$\frac{3}{10}, \frac{7}{30}, \frac{1}{3}, \frac{1}{5}, \frac{4}{15}$

[2] If $\chi = -\frac{7}{4} \times -\frac{4}{7}$, then Find the value of χ

[3] Find the result of : $\frac{7}{12} \times \frac{23}{45} + \frac{17}{12} \times \frac{23}{45} - 2 \times \frac{23}{45}$

[4] If $\chi = \frac{2}{3}$, $y = -\frac{1}{6}$, $z = -3$, then find : $(\chi \div y) - (z \div y)$

[5] find the number one fourth of the way from $-\frac{1}{9}$ to $-\frac{7}{8}$

General Exercises on the unit of Algebra

Exercise (1)

1 **Complete each of the following :**

[1] The degree of the term $-3a^2b$ is ..... and its coefficient is .....

[2] The increase of 7χ than 10χ is .....

[3] If $3a \times k = 12a^3$, then K = ...

[4] ..... $(3\chi + ...) = 9\chi^2 + 15\chi y$

[5] The perimeter of the rectangle whose dimensions are $(2\chi + 1)$ and $(2 - \chi)$ equals ..... unit length.

2 **Choose the correct answer from those given :**

[1] The algebraic expression $\chi^3 - 3\chi^2 + 4$ is of the ..... degree.

(a) first (b) second (c) third (d) fourth

[2] $2\chi + 3y$ is greater than $34 - 2\chi$ by .....

(a) $-6y$ (b) -4χ (c) 4χ (d) $6y$

[3] $-3\chi \times -5y$ equals :

(a) $-15\chi y$ (b) $-8\chi y$ (c) $8\chi y$ (d) $15\chi y$

[4] If $a^2 = 25$, $b^2 = 9$ and $ab = 15$, then $(a - b)^2$ .....

(a) -4 (b) 4 (c) 8 (d) 12

[5] $\frac{3\chi}{5} - \frac{\chi}{5}$ equals :

(a) $\frac{2}{5}$ (b) $\frac{\chi}{5}$ (c) $\frac{2\chi}{5}$ (d) 2χ

3 **[1]** Simplify to simplest from : $5\chi + 10y + 6\chi - 3y + 7y - 4\chi$

[2] find the product : $(2\chi - 3y)(2\chi + 3y)$.

4 **[1]** Find four rational numbers between $\frac{1}{3}$ and $\frac{7}{9}$

[2] Factorize by identifying the H.C.F. : $27\chi^4 - 18\chi^3$

5 **[1]** A rational number , if it is subtracted from its additive inverse , the result will be $\frac{3}{2}$ what is the number ?

[2] use the distribution property to find the value of :

$\frac{6}{37} \times 7 + \frac{6}{37} \times 5 + \frac{6}{37} \times (-11)$

Exercise (2)

1 **Complete the following :**

[1] $4a^2 + 8ab = 4a$ (..... + ...)

[2] $(4a^2 + 2a) \div 2a =$ (.....)

[3] $(50 + 1)(50 - 1) = 2500 -$ .....

[4] $a(a + b) - b(a + b) = (a + b) \times$ .....

[5] $\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times$ ..... $\times \frac{49}{50} =$ .....

2 **Choose the correct answer from those given :**

[1] The rational number $\frac{\chi}{-5}$ is negative if χ :

(a) > zero (b) < zero (c) ≤ zero (d) zero

[2] $(\chi + y)^2 - (\chi - y)^2$

(a) 0 (b) $-2\chi y$ (c) χy (d) $4\chi y$

[3] If a = 0 , b = 5 and c = 2 , then the numerical value of $a^2 b + a c$ equals :

(a) 0 (b) 2 (c) 7 (d) 10

[4] If $\frac{a}{b} = 60$, then $\frac{a}{3b}$ equals :

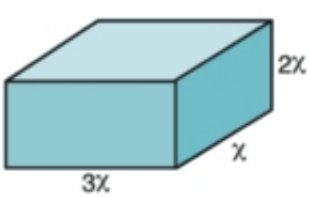
(a) 17 (b) 20 (c) 23 (d) 180

[5] In the figure opposite :

volume of the cuboid equals :

(a) 6χ (b) $6\chi^2$

(c) $5\chi^3$ (d) $6\chi^3$



3 [1] find the result of : $19 \times 17 + 19 \times 8 - 19 \times 15$

by identifying the Common factor.

[2] If $\chi = -\frac{1}{3}$, $y = \frac{3}{4}$ and $z = -3$, find the value of :

(a) $\chi^2 yz$ (b) $\chi y + yz$ (c) $\chi + y - Z$

4 [1] Divide : $\chi^3 y - 4\chi y^2 + 6\chi y$ by χy

[2] what is the increase of $3\chi^2 - 5\chi + 2$ than the sum of : $\chi + 5\chi^2 + 1$ and $2\chi^2 - 4 - 2\chi$

[3] simplify to simplest from : $\left(\frac{1}{3}\right)^2 \times \left(\frac{-1}{3}\right)^3 \div \left(\frac{-1}{3}\right)^4 \times \left(\frac{1}{5}\right)^0$

5 [1] Find the product : $(2\chi - 3y)(3\chi + 7y)$

[2] Simplify to simplest from $\frac{(17)^2 - 2 \times 17 + 17}{17}$

[3] If $a = 3\chi$, $b = \chi + 2$ and $c = 2\chi - 3$

Calculate the numerical value of the expression : $a\,b - c^2$ when $\chi = 0$

Exercise (3)

1 Complete the following :

[1] The degree of the algebraic term $-2\chi^2 y$ is ..... and its coefficient is .....

[2] $(4\chi^2 + 2\chi) \div 2\chi =$ .....

[3] If $a + 3b = 7$ and $c = 3$, then the value of the expression $a + 3(b + c) =$ .....

[4] The seventh term in the pattern $\frac{1}{10000}$, $\frac{1}{1000}$, $\frac{1}{100}$, ... is .....

[5] If $\chi + y = 5$, then the numerical value of $\chi^2 + 2\chi y + y^2$ is .....

2 Choose the correct answer from those given :

[1] If $(\chi + 4)(\chi - 3) = \chi^2 + m - 12$, then m equals : .....

(a) -7χ (b) $-\chi$ c. χ d. 7χ

[2] If $(\chi + y)^2 = 15$ and $\chi^2 + y^2 = 9$, then $\chi y =$ .....

(a) 1 (b) 2 (c) 3 (d) 4

[3] A rectangle whose length is 6ℓ and its width is 3 m , then its perimeter is .....

(a) $9\ell m$ (b) $18\ell m$ (c) $3(2\ell + m)$ (d) $6(2\ell + m)$

[4] If $\chi = 3$, $y = 4$ and $z = 6$, then $\frac{\chi}{y} - \frac{z}{\chi}$ equals : .....

(a) $-\frac{5}{4}$ (b) $\frac{1}{4}$ (c) $\frac{5}{4}$ (d) $\frac{7}{4}$

[5] The relation which represents the uniform velocity of a car covered a distance (s) in a time (t) is :

(a) $\frac{t}{s}$ (b) $\frac{s}{t}$ (c) ts (d) t + s

3 Simplify to simplest form : $3a(2a + 3b) - 2b(2a + 3b)$

[1] Simplify the expression $\frac{6\chi^3 y + 9y^3\chi}{3\chi y}$ to the simplest form.

[2] Find the product : $(\chi + 1)(\chi^2 - \chi + 1)$

4 [1] What is the decrease of $2a - 8b - c$ than the sum of $3a - 3b + c$ and $2a - 4b - 8c$

[2] Factorize by identifying the highest common factor :

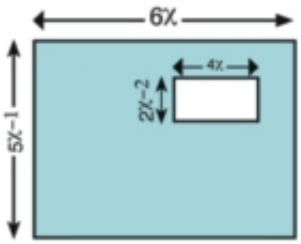
$5(48)^2 + 7 \times 48 + 53 \times 48$

[3] Find the result 201 x 199 as a d: difference of two squares.

5 [1] Simplify to simplest form : $4n(n+5)+n(6-n)$

then find the numerical value of the expression when $n=-1$

[2] Find the algebraic expression which represents the area of the shaded region :



General Exercises on Unit of Statistics

1 **Choose the correct answer from those given :**

[1] The arithmetic mean of the set of values 19 , 32 , 27 , 6 , 6 is .....

(a) 90 (b) 32 (c) 18 (d) 6

[2] The median of the set of values 15 , 22 , 9 , 11 , 33 is .....

(a) 9 (b) 15 (c) 18 (d) 90

[3] The median of the set of values 34 , 23 , 25 , 40 , 22 , 4 is .....

(a) 22 (b) 23 (c) 24 (d) 25

[4] If the arithmetic mean of six values is 12 , then the sum of these values equals : .....

(a) 2 (b) 6 (c) 18 (d) 72

[5] If the arithmetic mean of the values 27 , 8 , 16 , 24 , 6 , k is 14 , then k equals :.....

(a) 3 (b) 6 (c) 27 (d) 84

[6] If the order of the median of a set of values is the fourth , then number of these values equals : .....

(a) 3 (b) 5 (c) 7 (d) 9

[7] If the order of the median of a set of values is the fifth , then number of these values equals : .....

(a) 5 (b)6 (c) 9 (d)10

[8] If the median of the values 27 , 45 , 19 , 24 , 28 is χ , then χ equals : .....

(a) 24 (b) 27 (c) 28 (d) 45

2 **Complete the following :**

[1] The mode of the values 14 , 11 , 12 , 11 , 14 , 15 , 11 is .....

[2] If the mode of the values 15 , 9 , $\chi+1$, 9 , 15 is 9 , then $\chi=$ .....

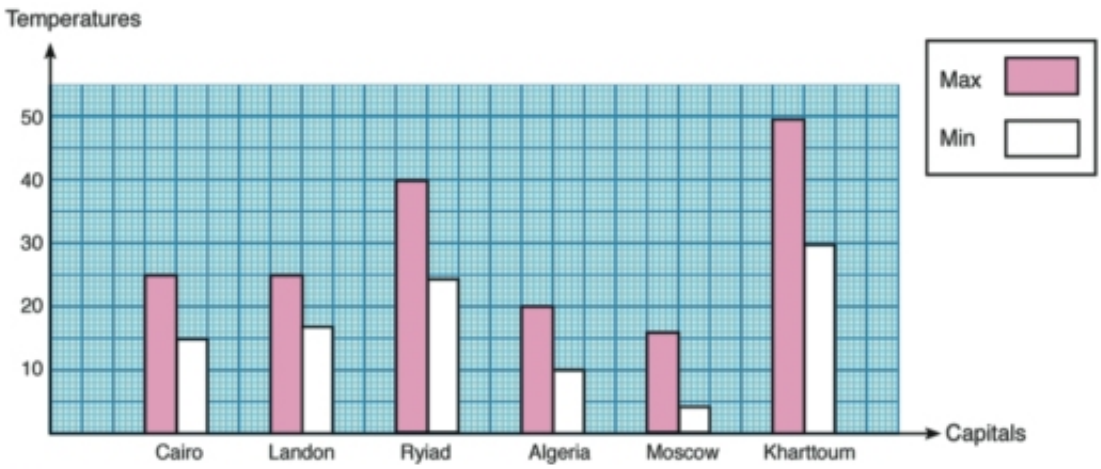
[3] The arithmetic mean of the values 18 , 35 , 24 , 6 equals .....

[4] If the arithmetic mean of the numbers 3 , 3 , χ equals 4 , then $\chi=$ .....

[5] If the arithmetic mean of the values 9 , 6 , 5 , 14 , k is 7 , then k = ...

[6] If the sum of five numbers is 30 , then the arithmetic mean of these numbers is .....

3 **If the maximum and minimum temperatures in April of sume Arab and world Capitals are shown as the opposite graph :**



Complete the following :

[1] The greatest maximum temperature is ..... in the capital .....

[2] The difference between the maximum and the minimum temperatures in Kharttoum equals .....

[3] The difference between the max. temperature in each of Ryiad and Moscow is .....

[4] The min. temperatures are equal in each of ..... , ...

[5] The mean of the max. temperature in each of Khartoum and Cairo equals .....

4 The following table shows the number of televisions in a factory from 2008 to 2011 :

Year / T.V. size	2008	2009	2010	2011
T.V. of 14 inchs	3000	2500	2700	2000
T.V. of 21 inchs	2000	2000	2000	2000
T.V. of 29 inchs	1200	1250	1400	1500
T.V. of 32 inchs	1000	800	1000	1200

Complete the following :

[1] The product whose numbers are increasing from year to another is .....

[2] The product whose numbers are decreasing from year to another is .....

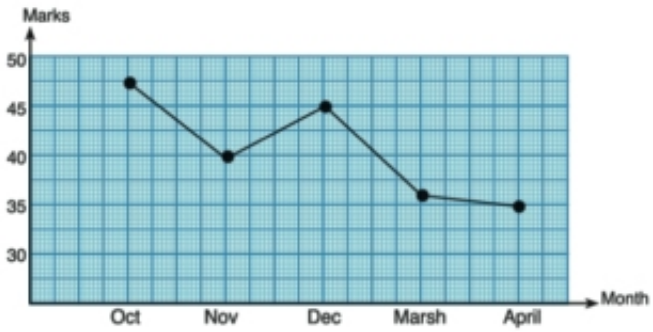
[3] The product whose numbers are equal during the four years is .....

[4] The percentage of increase the T.V. of 32 inch from 2010 to 2011 = ... %

5 The opposite graph represents the marks of a student in mathematics test during five months. Find :

[1] The difference between the greatest and the smallest mark, the student has got.

[2] If the maximum mark of the test is 50, then find the percentage of this student in March.



6 The following table shows the land areas cultivated with « Nile Crops » from 2001 to 2005 in thousand feddans.

Years	2001	2002	2003	2004	2005
The cultivated area	6800	6400	7000	6900	7200

First : Represent these data by a broken line graph.

Second : Complete the following using (increased or decreased) :

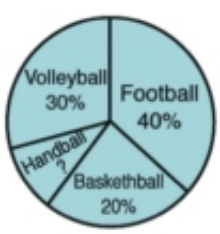
[1] The total area of cultivated land ..... from 2001 to 200[2]

[2] The total area of cultivated land ..... from 2002 to 200[3]

[3] The total area of cultivated land ..... from 2003 to 200[4]

[4] The total area of cultivated land ..... from 2004 to 200[5]

7 The figure opposite represents the percentage of the activities distribution for 960 students in one of schools. Complete the following :

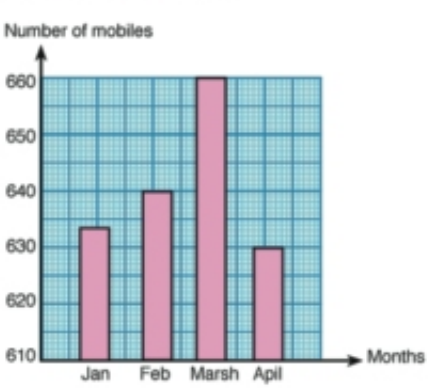


[1] The percentage of students who share in Handball = ... %

[2] The number of students who share in football = ...

[3] The measure of the central angle representing students who share in volley ball = ... °

8 The opposite graph represents mobiles sales for first four months.
represent these data by pie charts.



9 Answer the following questions :

[1] The following table shows the number of hours that two athletes trained in a month.

Kamal	63	70	58	30	48	53	75	72	68	46	57	66
Amer	68	56	65	70	50	49	57	62	64	54	52	63

Write the median hours of training for each athlete.

[2] The following table shows the marks of a student in mathematics during a school year.

Month	October	November	December	March	April	May
Marks	30	34	42	36	38	50

First : Find the arithmetic mean for the marks of this student.

Second : Find the difference between the greatest and the smallest mark.

[3] The following table shows the number of sleep's hours for each of Ahmed and Amro during a week.

Ahmed	5	7	6	9	8	6	8
Amro	9	8	9	8	6	9	7

First : Represent these data by a broken line graph.

Second : Find the mean hours for each of Ahmed and Amro.

[4] The students recorded the time of their bus Journeys to school for 3 weeks, they wrote times as follows : 16 , 18 , 14 , 17 , 18 , 15 , 19 , 13 , 15 , 22 , 16 , 21 , 20 , 13 , 18

Calculate each of the mean time , the median time and the mode time.

[5] If the arithmetic mean of a student's marks in five exams is 36 marks , what is the mark that he must get in the 6th exam to get his mean in the six exams 38 marks ?

[6] If the arithmetic mean of a student's marks in three exams (mathematics , science and social studies) is 40 marks , and his arithmetic mean in another two exams (Arbic and English) is 4[2]5 marks.

Find the arithmetic mean of his marks in the five exams.

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Models of Examinations of Algebra and statistics

Model (1)

1 Complete the following :

[1] The number that hasn't a multiplicative inverse is .....

[2] $\frac{3}{4}$ = ... %

[3] $(2\chi - 3)(3\chi + 5) = 6\chi^2 +$ ..... $- 15$

[4] $3\chi^2 + 15\chi y = 3\chi$ (..... + ...)

[5] If the order of the median of a set of values is the fifth , then the number of these Values is .....

2 Choose the correct answer from those given :

[1] $\left|\frac{-2}{3}\right|$ ..... zero.

(a) > (b) < (c) = (d) ≤

[2] The algebraic term $2\chi^3 y^2$ whose degree is .....

(a) the second (b) the third (c) The fourth (d) the fifth

[3] The arithmetic mean of the values : 2 , 2 , 3 , 6 , 7 is .....

(a) 2 (b) 3 (c) 4 (d) 5

[4] $(-3\chi^2 y)^2 \times 2\chi y =$ .....

(a) $-18\chi^5 y^3$ (b) $18\chi^5 y^3$ (c) $6\chi^3 y^2$ (d) $9\chi^2 y^2$

[5] If the median of the value : a + 3 , a + 2 , a + 4 (where a is a positive integer) is 8 , then a equals : .....

(a) 2 (b) 3 (c) 4 (d) 5

3 [1] Find the simplest form the value of each of the following :

(1) $-27\frac{1}{4} + 13\frac{1}{2}$ **(2)** 0.18 – 30%

[2] Using the properties of the rational numbers , find the value of :

$$\frac{7}{12} \times \frac{23}{45} + \frac{17}{12} \times \frac{23}{45} - 2 \times \frac{23}{45}$$

4 [1] First : Subtract $5\chi^2 + y^2 - 3\chi y$ from $\chi^2 - 2\chi y + 3y^2$

Second : Divide $6\chi^2 + 13\chi y + 6y^2$ by $2\chi + 3y$

[2] *Simplify :* $(2a - 3)(2a + 3) + 7$, then find the numerical value of the result when $a = -1$

5 **The folxlowing table shows Gehaad's marks in 6 mathematics examination:**

Month	October	November	December	February	March	Apeil
Mark	30	35	42	37	44	50

(a) Draw a broken line for the previous table.

(b) Find each of the median mark and the mean mark.

Model (2)

1 **Complete the following :**

[1] The algebraic term $-3\chi y^3$ whose degree is .....

[2] The arithmetic mean of the value 3 , 5 , 4 , 9 , 4 is .....

[3] $2\chi^2 y \times$ ..... $= 12\chi^3 y$

[4] If $\frac{\chi}{24} = \frac{5}{12}$, then $\chi =$ .....

[5] If the order of the median of a set of values is the fourteenth , then the number of these values equals .....

2 **Choose the correct answer from those given :**

[1] $\frac{-3}{5} + \frac{2}{3} =$ .....

(a) $\frac{6}{5}$ (b) $\frac{1}{15}$ (c) 5 (d) 3

[2] The necessary condition to make $\frac{5}{\chi - 3}$ a rational number is .....

(a) $\chi = -3$ (b) $\chi = 3$ (c) $\chi \neq 3$ (d) $\chi = 5$

[3] $|-13| - |13| =$ .....

(a) -26 (b) -13 (c) 0 (d) 26

[4] The mode of the values : 4 , 5 , 4 , 3 , 7 , 5 , 4 is .....

(a) 3 (b) 4 (c) 5 (d) 7

[5] The highest common factor of the expression $3\chi^2 y - 6\chi$ is .....

(a) 3χ (b) 6χ (c) $3\chi y$ (d) $\chi y - 2$

3 **[1] Simplify to simplest form :** $\frac{3}{7} \times \frac{5}{6} + \frac{3}{7} \times \frac{7}{6} - \frac{3}{7}$

[2] Find three rational numbers between $\frac{1}{2}$, $\frac{1}{3}$

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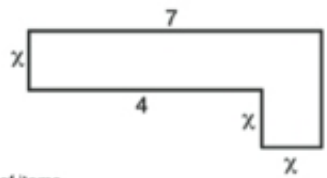
4 **[1] Add :** $2\chi - 7y + Z$, $5Z + 6y - 2\chi$

[2] Divide : $6\chi^2 y + 9\chi y^2 - 12\chi^2 y3$ by $3\chi y$

[3] If $\chi = \frac{1}{2}$, $y = \frac{-2}{3}$, $Z = 2$, then find the the value of $\frac{y - z}{\chi}$

5 **[1] In the figure opposite :**

Find the perimeter and the area of the figure



[2] The graph shows the number of pens , Pencils , rulers and erasers sold by a store in one week.

Names of the items are not on the graph , Pens are the most soled items , the erasers are the fewer to be sold , pencils are more than the rulers.

First : How many pencils were sold.

Second : Arrange items from fewer to most number.

Model (3)

1 **Complete the following :**

[1] The algebraic term $-4\chi y^2$ of ..... degree.

[2] $|-5| - |2| =$ .....

[3] $(2\chi - 3)(\chi + 4) = 2\chi^2 +$ ..... $- 12$

[4] $6\chi^3 = 2\chi \times$ .....

[5] 1 , 1 , 2 , 3 , 5 , 8 , ... (in the same pattern)

2 **Choose the correct answer from those given :**

[1] If $\frac{\chi}{y} = 1$, then $3\chi - 3y =$ .....

(a) 0 (b) 1 (c) 3 (d) 6

[2] The remainder of subtracting (-5χ) from 3χ equals : .....

(a) -2χ (b) 2χ (c) $8\chi^2$ (d) 8χ

[3] The arithmetic mean of the numbers : 3 , 6 , 1 , 6 is .....

(a) 3 (b) 4 (c) 6 (d) 16

[4] The mode of the values : 1 , 3 , 7 , 3 , 6 , 7 , 3 is .....

(a) 1 (b) 3 (c) 6 (d) 7

[5] If $\chi + \frac{3}{\chi} = 4 + \frac{3}{4}$, then χ = ...

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) 3 (d) 4

3 **[1] First :** find by Inspection method the product of : $(\chi - 2)(\chi + 2)$

Second : Divide $6\chi^3 - 2\chi^2$ by 2χ , $\chi \neq 0$

[2] Use the property of distribution to find the result of : $\frac{3}{7} \times 2 + \frac{3}{7} \times 6 - \frac{3}{7}$

4 **[1] First :** Add $5\chi + 2y - 1$ and $2\chi - 5y + 3$

Second : Find the quotient of $2\chi^3 - 5\chi^2 - 22\chi - 15$ by $2\chi + 3$

[2] Subtract $-a^2 - 5ab + 4b^2$ from $3a^2 - 2ab - 2b^2$

5 **[1]** Factorize by identifying the H.C.F. : $3a(a - 2b) - 6(a - 2b)$, then find the numerical value of the result when $a - 2b = |-\frac{1}{3}|$

[2] If the arithmetic mean of the vlues 8 , 7 , 5 , 9 , 4 , 3 , k + 4 is 6 , then find the value of K

Model (4)

1 **Complete the following :**

[1] $3\frac{1}{4} \times$ ..... = 1

[2] If $\frac{a}{b} = \frac{1}{2}$, then $\frac{2a}{b}$ = ...

[3] If the mode of the values , 7 , 5 , $\chi + 4$, 7 is 7 , then χ = ...

[4] If $(\chi - y)(3\chi + 2y) = 3\chi^2 + k\chi y - 2y^2$, then k = ...

[5] The rational number that lies one fifth of the way from $\frac{1}{2}$ to 1

2 **Choose the correct answer from those given :**

[1] The property used in the operation : $\frac{6}{7} \times 1 = \frac{6}{7}$ is .....

(a) Associative (b) Commutative

(c) Multiplicative-identity (d) Multiplicative-inverse.

[2] Square of the sum of the two monomials a , b is .....

(a) $a^2 + b^2$ (b) $(a + b)^2$ (c) 2 (a + b) (d) 2 a b

[3] The median of the value 4 , 8 , 3 , 5 , 7 is .....

(a) 3 (b) 4 (c) 5 (d) 7

[4] If the mode of the values : 7 , 5 , y + 3 , 5 , 7 is 7 , then y = ...

(a) 3 (b) 4 (c) 5 (d) 7

[5] If $(\chi - 3)(\chi + 3) = \chi^2 + k$, then k = ...

(a) –9 (b) 3 (c) 6 (d) 9

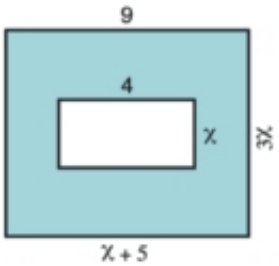
3 **[1] First :** Simplify to the simplest form : $(\chi + 2)^2 - (\chi + 2)(\chi - 2)$

Second : Add : $3\chi - 2y + 5$ and $2\chi + y - 3$

[2] In the figure opposite :

find the algebraic expression which represents

The area of the shaded region.



4 **[1] First :** Find the value of : $-13\frac{7}{8} - \left(-6\frac{7}{8}\right)$

Second : Use the distribution property to find the vlue of :

$$\frac{5}{17} \times 10 + \frac{5}{17} \times 23 \times \frac{5}{17}$$

[2] If $a = \frac{7}{4}$, $b = -\frac{1}{2}$, Find the value of the expression $(a - b) \div (a + b)$

5 **[1]** Find the quotient of : $20\,a^3 b^2 + 15\,a^2 b^3 + 10\,a\,b$ by $5\,a\,b$

[2] The following table shows distribution of marks of 30 students in one the tests :

Marks	6	9	12	15	17	Total
No. of stud.	4	7	8	5	6	30

Represent these data by a bar chart , then find the mode mark.

Model (5)

1 **Complete the following :**

[1] The rational number which hasn't a multiplicative inverse is .....

[2] $\left(\frac{-5}{7}\right) \times \left(\frac{-7}{5}\right) =$ .....

[3] The number that lies half way between $\frac{1}{2}$ and $\frac{5}{8}$ is .....

[4] $24\,\chi^4\,y^6 = 6\,\chi^2\,y^3 \times$ .....

[5] If the mode of the vlues 5 , 7 , a + 1 , 6 , 4 is 4 , then a = ...

2 **Choose the correct answer from those given :**

[1] The remainder of subtracting $\frac{1}{3}$ from $\frac{4}{3}$ is .....

(a) $-\frac{5}{3}$ (b) 1 (c) $\frac{2}{3}$ (d) $\frac{5}{3}$

[2] The necessary condition to make $\frac{7}{\chi + 5}$ a rational number is $\chi \neq$ .....

(a) – 5 (b) 5 (c) $\frac{7}{5}$ (d) 7

[3] If the arithmetic mean of marks of five students is 30 , then the sum of their marks is .....

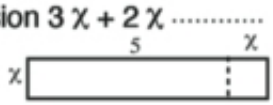
(a) 6 (b) 30 (c) 35 (d) 150

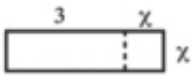
[4] The order the median of the values 6 , 2 , 5 , 4 , 1 is .....

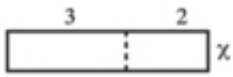
(a) 1 (b) 2 (c) 3 (d) 4

[5] Which of the following represents the expression $3\chi + 2\chi$ .....

(a)

(b) 

(c) 

(d) 

3 **[1]Find** the result of the following using the highest common factor :

$(17)^2 - 8 \times 17 + 17$

[2] Find the quotient of χ^3 y 3 – 4 $\chi^2\,y^2$ + 6 χ y 2 by χ y

4 **[1]** If $\chi = \frac{3}{4}$, $y = \frac{-5}{2}$, then find in simplest form the value of the expression : $\frac{\chi - y}{\chi + y}$

[2] Use the properties of addition of rational number to find the value of :

$\frac{5}{4} + \left(\frac{-13}{5}\right) + \left(\frac{-25}{4}\right) + \frac{28}{5}$

5 **[1] In the figure opposite :**

The two cuboids are melted to make another cuboid whose height is (a+ b), find the base area of the new cuboid.

[2] The following table shows number of students in grades the first , the second and the third preparatory in a school.

Grade	Number of students
First	220
Second	200
Third	180

1st grade	
2nd grade	
3rd grade	

Represent the number of students in grades the second and the third prep. in the pictograph

GEOMETRY

General exercises on geometric concepts, constructions

Exercise (1)

1 ***Choose the correct answer from those given :***

[1] The acute angle supplements ..... angle.

(a) acute (b) obtuse (c) right (d) reflex

[2] The right angle complements angle whose measure is .....

(a) 0° (b) 45° (c) 90° (d) 180°

[3] If m (∠ A) = 2 m (∠ B) , ∠ A complements ∠ B , then m (∠ A) = ...

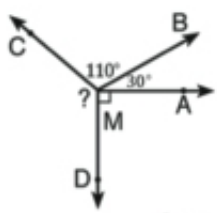
(a) 15° (b) 30° (c) 45° (d) 60°

[4] If the ratio between two supplementary angles is 4 : 5, then the measure of the greater angle is .....

(a) 80° (b) 100° (c) 120° (d) 150°

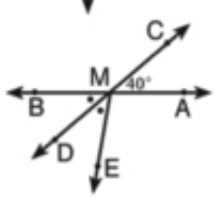
2 ***In the figure opposite :***

m (∠ AMB) = 30°, m (∠ BMC) = 110° and m (∠ AMD) = 90°. Find m (∠ CMD).



3 ***In the figure opposite :***

$\overleftrightarrow{AB} \cap \overleftrightarrow{CD}$ = {M} , m (∠ AMC) = 40° and $\overrightarrow{MD}$ bisects ∠ BME. find m (∠ AME)



4 Using the compasses, Draw an angle of measure 120°, then divide it into four equal angles in measure. (Don't remove the arcs)

Exercise (2)

1 ***Complete :***

[1] The measure of the straight angle equals ..... °

[2] The angle whose measure is 36° complements an angle of measure ..... and supplements an angle of measure .....

[3] If the two outer sides of two adjacent angles are on the same straight line, then the two angles are .....

[4] The sum of the measures of the accumulative angles at a point is .....

[5] The angle whose measure is greater than 180° but less than 360° is called .....

2 **Choose the correct answer from those given :**

[1] If m (∠ A) = 90°, then m (reflex ∠ A) = ...

(a) 0° (b) 90° (c) 180° (d) 270°

[2] The measure of the straight angle equals .....

(a) 90° (b) 180° (c) 270° (d) 360°

[3] The angle whose measure is 179°, its type is .....

(a) acute (b) right (c) obtuse (d) straight

[4] The sum of the measures of two adjacent angles formed by a straight line and a ray is .....

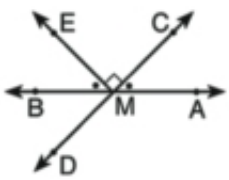
(a) 90° (b) 180° (c) 270° (d) 360°

3 **In the figure opposite :**

$\overleftrightarrow{AB} \cap \overleftrightarrow{CD} = \{M\}$, m (∠ CME) = 90°,

m (∠ AMC) = m (∠ EMB). find :

m (∠ AMC), m (∠ BMD), m (∠ AMD).

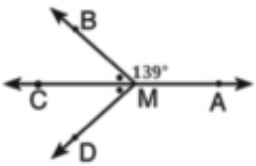


4 **In the figure opposite :**

$\overrightarrow{MC}$ bisects ∠ BMD, m (∠ BMD) = 82°,

m (∠ AMB) = 139°. prove that :

$\overrightarrow{MA}$, $\overrightarrow{MC}$ are on the same straight line.



5 Using the ruler and the compasses, draw the equilateral triagnle ABC of side length 6 cm. Bisect each of ∠ A, ∠ B and ∠ C to intersect at M. prove that MA = MB = MC

(Don't remove the arcs)

Exercise (3)

1 ***Complete :***

[1] The acute angle is the angle whose measure is less than ..... and more than .....

[2] The two complement angles whose sum of their measures is .....

[3] The complements of the equal angles in measure are .....

[4] The two adjacent angles formed by a straight line and a ray .....

[5] If two straight lines intersect, then each two vertically opposite angles are .....

2 *Choose the correct answer from those given :*

[1] The angle whose measure is 37° complements an angle of measure .....

(a) 37° (b) 53° (c) 63° (d) 143°

[2] The type of the angle whose measure equals 89°, is .....

(a) acute (b) right (c) obtuse (d) reflex

[3] If m (∠ A) + m (∠ B) = 180°, then ∠ A and ∠ B are .....

(a) adjacent (b) complementary

(c) supplementary (d) equal in measure

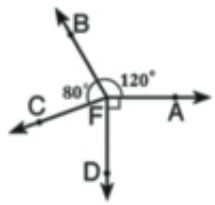
[4] The sum of the measures of the accumulative angles at a point equals .....

(a) 90° (b) 180° (c) 270° (d) 360°

[5] If the ratio between two adjacent and supplementary angles is 1 : 2, then the measure of the smaller angle is .....

(a) 30° (b) 60° (c) 120° (d) 150°

3 In the figure opposite :

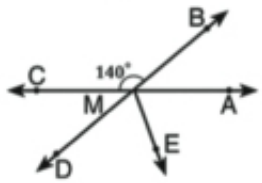


m (∠ AFB) = 120°, m (∠ BFC) = 80°, and

m (∠ AFD) = 90°

find : m (∠ CFD).

4 In the figure opposite :



$\overleftrightarrow{AC} \cap \overleftrightarrow{BD} = \{M\}$, $\overleftrightarrow{ME}$ bisect (∠ AMD).

find : (∠ AMD), m (∠ AME).

5 Using the ruler and the compasses, draw Δ ABC in which AB = 4 cm, BC = 5 cm, CA = 6 cm, D ∈ $\overrightarrow{BC}$, D ∉ $\overline{BC}$ then :

first : Draw ∠ DBE ≡ m ∠ A Second : Complete : m (∠ ABE) = m (∠ .....)

General exercises on congruence

1 Complete the following :

[1] The two triangles are congruent if two sides and ..... are congruent with their corresponding in the other triangle.

[2] The two right-angled triangles are congruent if .....

[3] Two triangles are congruent if two angles and ..... are congruent with their corresponding in the other triangle.

[4] Two triangles are congruent if each ..... of one triangle are congruent with their corresponding in the other triangle.

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[5] If the two triangles ABC and DEF are congruent,

then : BC = ... , m (∠ E) = m (∠ .....)

[6] If DE = XY, DF = XZ and m (∠ D) = m (∠ X),

then ΔΔ ..... , ...) are congruent.

[7] The two triangles XYZ and MNL are congruent, if YZ = 8 cm, m (< Y) = 40°

then in the other triangle : ..... = 8 cm , m (∠ .....) = 40°

2 Choose the correct answer from those given :

[1] Two triangles are congruent if ..... are congruent.

(a) two corresponding sides

(b) two corresponding sides and the included angle

(c) a side and an angle with their corresponding

(d) their corresponding angles

[2] If AB = DF = 5 cm , AC = DE = 7 cm , m (∠ A) = m (∠ D) = 55° then the two triangles ABC , DFE are congruent with .....

(a) two sides and the included angle (b) three sides

(c) two angles (d) hypotenuse and a side

[3] If the two triangles ABC , XYZ are congruent, then .....

(a) AB = YZ (b) BC = XZ

(c) YX = CA (d) ZY = CB

[4] The following triangles are congruent except figure (.....) :

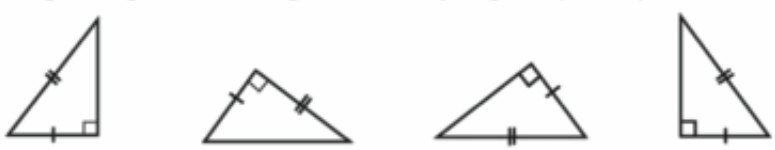


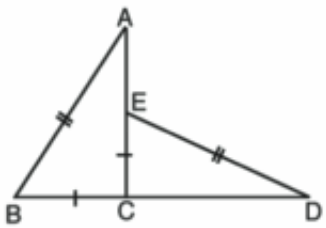
figure (1) figure (2) figure (3) figure (4)

[5] In the figure opposite :

if AB = DE , BC = EC , then m (∠ A) = ...

(a) m (∠ B) (b) m (∠ D)

(c) m (∠ DEC) (d) m (∠ ACD)

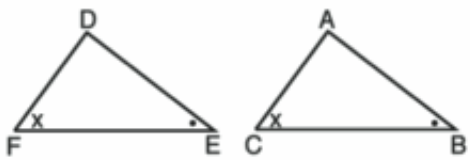


[6] In the figure opposite : The necessary condition to make ΔABC , Δ DEF are congruent if:

(a) AB = DE (b) AC = DF

(c) BC = EF

(d) m (∠ A) = m (∠ D)



[7] In the following figures : pair of congruent triangles is figure (.....) :

figure (1) figure (2) figure (3) figure (4)

3 ***In the figures below : Are the two triangles congruent ? (give reason) ,***

Note : The similar signs denote the congruency of the elements marked by them.

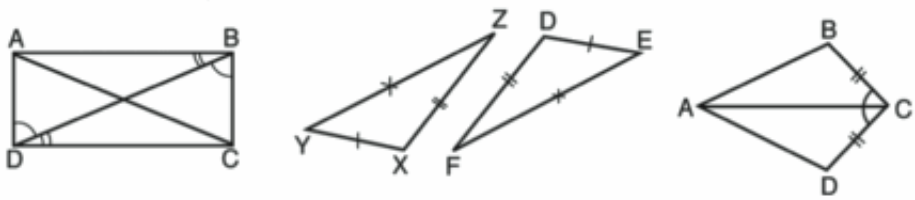


figure (1) figure (2) figure (3)

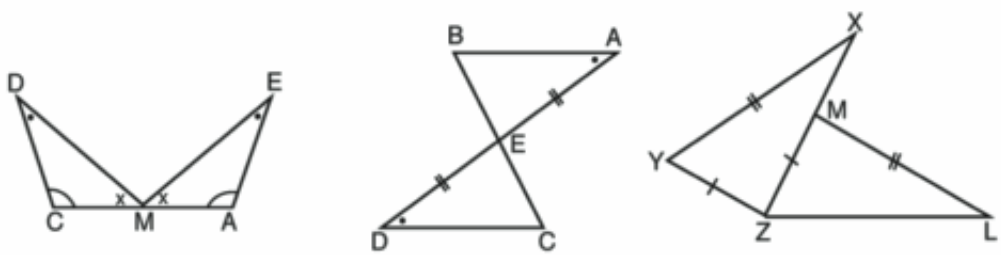


figure (4) figure (5) figure (6)

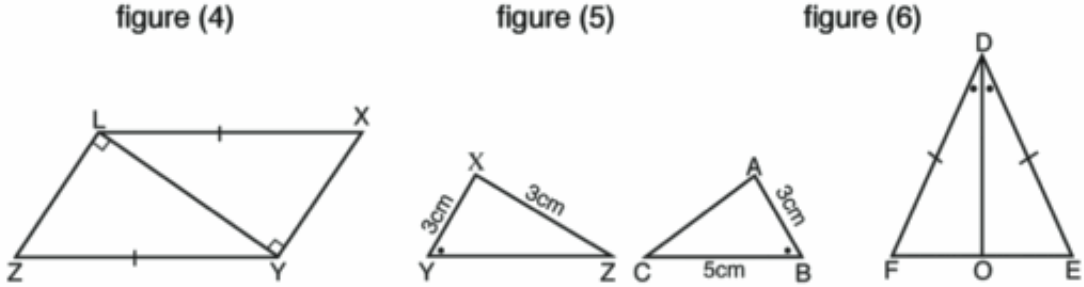


figure (7) figure (8) figure (9)

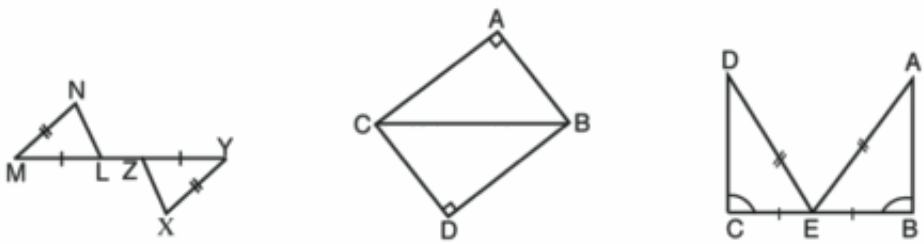


figure (10) figure (11) figure (12)

General exercises on parallelism

1 ***Complete the following :***

[1] If a straight line intersects two parallel straight lines, then every two interior angles on one side of the transversal are .....

[2] Two straight lines are parallel if they are cut by a transversal such that the two interior angles on one side of the transversal .....

[3] If two straight lines are parallel to a third straight line, then these two straight lines .....

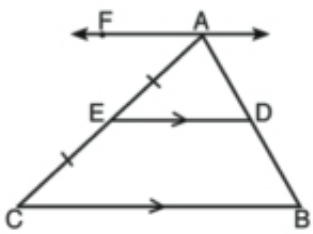
[4] A straight line that is perpendicualr to one of two parallel lines is .....

[5] The two straight lines perpendicular to a third one are .....

[6] In the figure opposite :

If AB = 3 cm

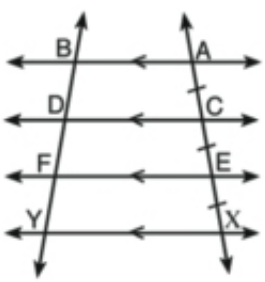
then BD = ... cm



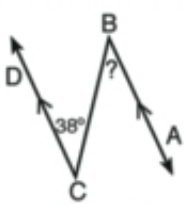
[7] In the figure opposite :

If BF = 2 cm

then BY = ... cm



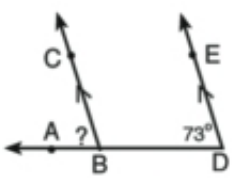
2 **In each of the following figures, find m (∠ ABC) :**



$\overrightarrow{BA}$ // $\overrightarrow{CD}$

m (∠ BCD) = 38°

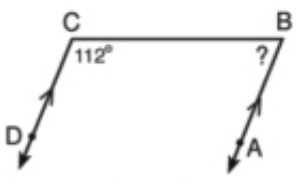
figure (1)



$\overrightarrow{DE}$ // $\overrightarrow{BC}$

m (∠ EDB) = 73°

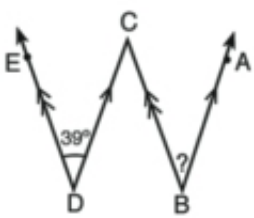
figure (2)



$\overrightarrow{BA}$ // $\overrightarrow{CD}$

m (∠ BCD) = 112°

figure (3)

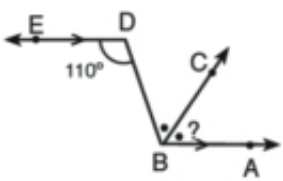


$\overrightarrow{BA}$ // $\overrightarrow{DC}$

$\overrightarrow{BC}$ // $\overrightarrow{DE}$

m (∠ CDE) = 39°

figure (4)

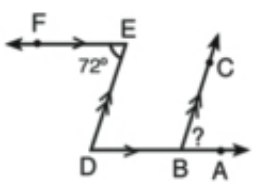


$\overrightarrow{BA}$ // $\overrightarrow{DE}$

$\overrightarrow{BC}$ bisects ∠ ABD

m (∠ BDE) = 110°

figure (5)



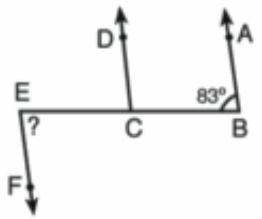
$\overrightarrow{DA}$ // $\overrightarrow{EF}$

$\overrightarrow{BC}$ // $\overrightarrow{DE}$

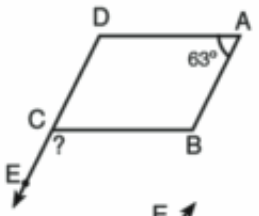
m (∠ DEF) = 72°

figure (6)

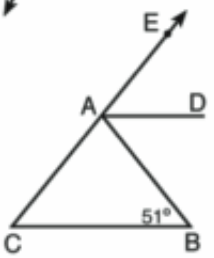
3 **In the figure opposite :**
$\overrightarrow{BA} \parallel \overrightarrow{CD}$, $\overrightarrow{CD} \parallel \overrightarrow{EF}$
and m (∠ ABC) = 83°
find : m (∠ CEF).



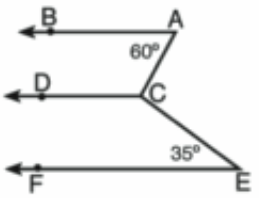
4 **In the figure opposite :**
$\overrightarrow{AB} \parallel \overrightarrow{DC}$, $\overrightarrow{AD} \parallel \overrightarrow{BC}$
and m (∠ BAD) = 63°
find : m (∠ BCE).



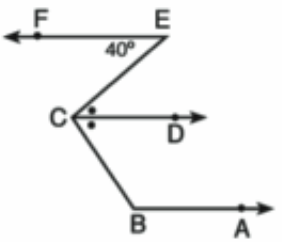
5 **In the figure opposite :**
$\overrightarrow{AD} \parallel \overrightarrow{CB}$
$\overrightarrow{AD}$ bisects ∠ BAE
and m (∠ B) = 51°
find : m (∠ BAD) , m (∠ C).



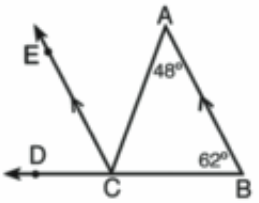
6 **In the figure opposite :**
$\overrightarrow{AB} \parallel \overrightarrow{CD}$, $\overrightarrow{AB} \parallel \overrightarrow{EF}$
m (∠ A) = 60° and m (∠ E) = 35°
find : m (∠ ACE).



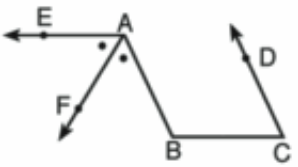
7 **In the figure opposite :**
$\overrightarrow{BA} \parallel \overrightarrow{CD}$, $\overrightarrow{CD} \parallel \overrightarrow{EF}$
$\overrightarrow{CD}$ bisects ∠ BCE
and m (∠ CEF) = 40°.
find : m (∠ B).



8 **In the figure opposite :**
$\overrightarrow{BA} \parallel \overrightarrow{CE}$, m (∠ A) = 48°
D ∈ $\overrightarrow{BC}$, m (∠ B) = 62°
find : m (∠ ECD) , m (∠ ACE) , and
m (∠ ACB).



9 **In the figure opposite :**
$\overrightarrow{CD} \parallel \overrightarrow{BA}$, $\overrightarrow{CB} \parallel \overrightarrow{AE}$
$\overrightarrow{AF}$ bisects ∠ BAE , and
m (∠ FAE) = 58°
Find : m (∠ C).



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10 **In which of the following figures : $\overleftrightarrow{AB} // \overleftrightarrow{CD}$**

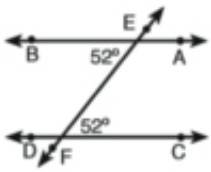


figure (1)

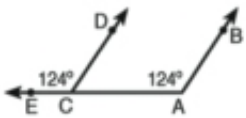


figure (2)

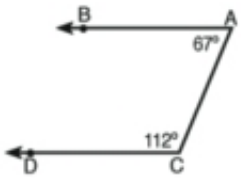


figure (3)

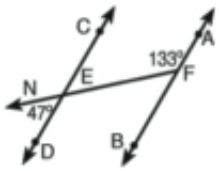


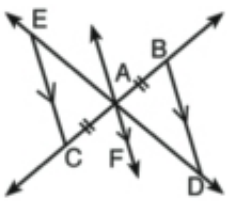
figure (4)

11 **In the figure opposite :**

$\overleftrightarrow{BD} // \overleftrightarrow{AF} // \overleftrightarrow{CE}$, AB = AC and

DE = 12 cm.

find the length of $\overline{AD}$.

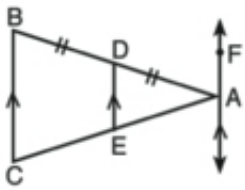


12 **In the figure opposite :**

$\overleftrightarrow{AF} // \overleftrightarrow{DE} // \overleftrightarrow{BC}$, AD = BD

AD = 5 cm , AE = [4]5 cm , BC = 6 cm

find the perimeter of Δ ABC.



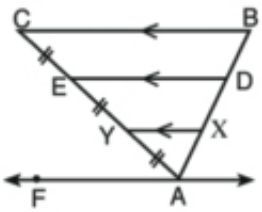
13 **In the figure opposite :**

$\overleftrightarrow{AF} // \overleftrightarrow{XY} // \overleftrightarrow{DE} // \overleftrightarrow{BC}$ and

AY = YE = EC ,

AY = 3 cm , AX = 2 cm ,

the perimeter of Δ ABC = 23 cm find BC.



Model of examinations of geometry

Model (1)

1 **Complete the following :**

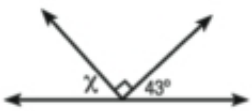
[1] The complement of an angle of measure 43° equals .....°

[2] The straight line that is perpendicular to one of two parallel lines is .....

[3] Two triangle are congruent if two angles .....

[4] In the figure opposite :

m (∠ X) = ... °



[5] The number of triangles in the opposite figure equals .....

2 **Choose the correct answer from those given :**

[1] The supplement of an angle of measure 30° is .....

(a) 30° (b) 60° (c) 120° (d) 150°

[2] The two intersecting straight lines : .....

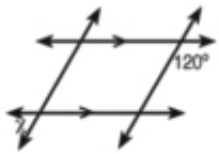
(a) perpendicular. (b) are on the same plane.

(c) skew. (d) are not on the same plane.

[3] In ΔABC : if m ($\angle$ B) = 3 m ($\angle$ A) = 90° , then m ($\angle$ C) = ...

(a) 30° (b) 45° (c) 60° (d) 90°

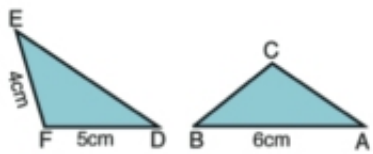
[4] In the figure opposite :



m ($\angle$ X) = ... °

(a) 30° (b) 60° (c) 90° (d) 120°

[5] In the figure opposite :

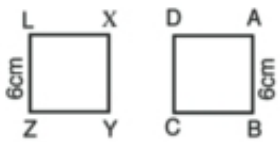


If $\Delta ABC = \Delta DEF$

then the perimeter of ΔABC =

(a) 9 cm (b) 10 cm (c) 11 cm (d) 15 cm

3 **[1] In the figure opposite :**



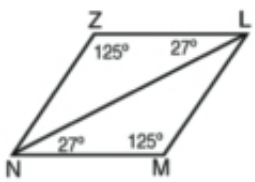
ABCD , XYZL are two squares

where AB = 6 cm , ZL = 6 cm.

Are the two squares congruent ? Give reason.

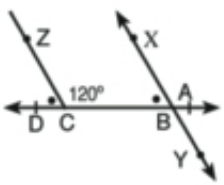
[2] ***Using the ruler and the compasses***, Draw ΔABC in which AB = AC = 5 cm and BC = 6 cm, then draw $\overline{AD} \perp \overline{BC}$ where $\overline{AD} \cap \overline{BC} = \{D\}$, then find by measuring the length of $\overline{AD}$. (Don't remove the arcs)

4 **[1] In the figure opposite :**



Prove that : the two triangles LMN and NZL are congruent. then find m ($\angle$ LNZ).

[2] In the figure opposite :

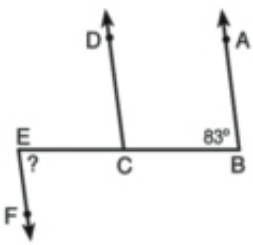


$\overleftrightarrow{AD} \cap \overleftrightarrow{XY} = \{B\}$, m ($\angle$ BCZ) = 120°,

m (< XBC) = m ($\angle$ ZCD)

is $\overleftrightarrow{XY} \parallel \overleftrightarrow{CZ}$? then find m ($\angle$ ABY).

5 **[1] In the figure opposite :**

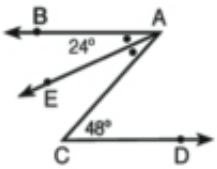


$\overrightarrow{BA} \parallel \overrightarrow{CD}$, $\overrightarrow{CD} \parallel \overrightarrow{EF}$ and

m ($\angle$ ABC) = 83°

find m ($\angle$ CEF).

[2] In the figure opposite :



$\overrightarrow{AE}$ bisects ∠ BAC , m (∠ BAE) = 24°

m (∠ ACD) = 48°. Complete :

First : m (∠ BAC) = ... °

Second : $\overrightarrow{AB}$ // .....

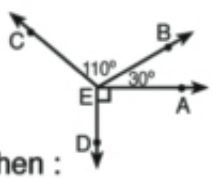
Model (2)

1 Complete the following :

[1] If m (∠ B) = 160° , then m (reflex ∠ B) = ... °

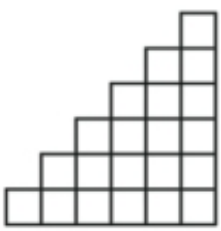
[2] If m (∠ A) supplements ∠ B and ∠ A ≡ ∠ B, then m (∠ B) = ... °

[3] In the figure opposite :



m (∠ CED) = ...

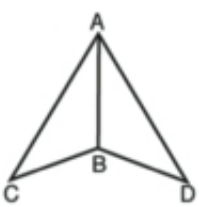
[4] In the figure opposite :



If the square □ represents the unit area, then :

the area of the figure = ... unit area.

[5] In the figure opposite :



If Δ ABC ≡ Δ ABD let the perimeter of the figure ACBD = 20 cm and AB = 6 cm, then perimeter of Δ ABC = ... cm.

2 Choose the correct answer from those given :

[1] The angle whose measure is more than 180° and less than 360° is called .....

(a) acute (b) obtuse (c) straight (d) reflex

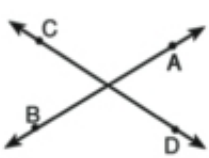
[2] If the ratio between two supplementary angles is 7 : 11, then the measure of the smaller angle is : .....

(a) 35° (b) 55° (c) 70° (d) 110°

[3] The sum of the measures of the accumulative angles at a point is .....

(a) 90° (b) 180° (c) 270° (d) 360°

[4] The two angles AMD, BMC are called :



(a) vertically opposite angles (b) adjacent

(c) alternate (d) corresponding

[5] All of the following triangles are congruent except figure (.....)

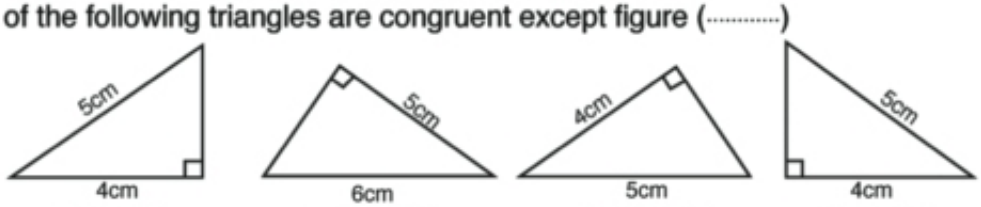
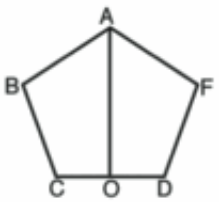


figure (a) figure (b) figure (c) figure (d)

3 **[1] In the figure opposite :**



The figure ABCO ≡ the figure AFDO

(a) Mention the corresponding vertex to C.

(b) Explain why $\overrightarrow{AO}$ bisect ∠ BAF.

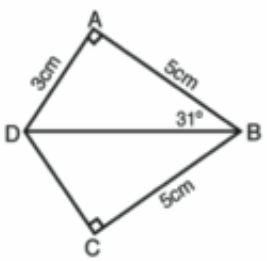
(c) Explain why $\overrightarrow{AO}$ is the axis of symmetry of $\overline{CD}$

[2] Using the ruler and the compasses, Draw Δ ABC in which

AB = AC = 6 cm , BC = 5 cm. Bisect ∠ B , ∠ C by two bisectors

which intersect at M. prove by measuring that : MB = MC (Don't remove the arcs)

4 **[1] In the figure opposite :**



m (∠ BAD) = m (∠ BCD) = 90°

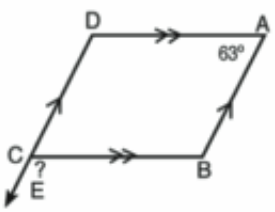
m (∠ ABD) = 31°,

AB = CB = 5 cm, AD = 3 cm

(a) Prove that : the two triangles ABD and CBD are congruent.

(b) find the length of $\overline{CD}$.

[2] In the figure opposite :

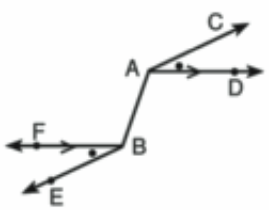


$\overrightarrow{AB}$ // $\overrightarrow{DC}$, $\overrightarrow{AD}$ // $\overrightarrow{BC}$ and

m (∠ BAD) = 63°

find m (∠ BCE).

5 **[1] In the figure opposite :**

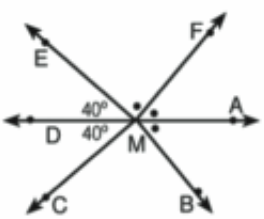


$\overrightarrow{AD}$ // $\overrightarrow{BF}$

m (∠ CAD) = m (∠ EBF)

prove that : $\overrightarrow{AC}$ // $\overrightarrow{BE}$

[2] In the figure opposite :



If M ∈ $\overleftrightarrow{AD}$, m (∠ CMD) = m (∠ EMD) = 40°,

m (∠ AMB) = m (∠ AMF) = m (∠ EMF).

Find : First : m (∠ AMF).

Second : m (∠ BMC).

Third : Are the points B, M and E collinear ? Why ?

Model (3)

1 Complete the following :

[1] Two adjacent angles formed by a straight line and a ray with a starting point on this straight line .....

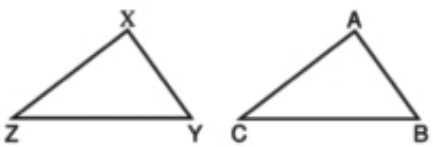
[2] The angle whose measure is 46° vertically opposite to an angle whose measure is .....

[3] If m (∠ A) = 125° , then m (reflex ∠ A) = ...°

[4] In the figure opposite :

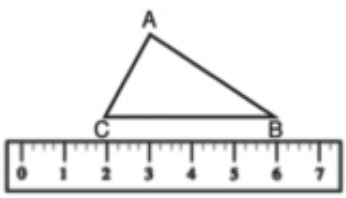
If Δ ABC ≡ Δ XYZ,

m (∠ A) + m (∠ B) = 140° , then m (∠ Z) = ...°



[5] In the figure opposite :

The length of $\overline{AB}$ approximated to the nearest half unit length used equals ..... cm.



2 Choose the correct answer from those given :

[1] If two adjacent angles are complementary, then their outer sides are .....

(a) perpendicular (b) congruent

(c) skew (d) on a straight line

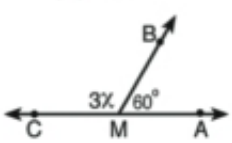
[2] If ∠ A , ∠ B are supplementary and m (∠ A) = m (∠ B), then m (∠ A) equals :

(a) 45° (b) 60° (c) 90° (d) 180°

[3] In the figure opposite :

If $\overleftrightarrow{AC} \cap \overrightarrow{MB} = \{M\}$,

then the value of X equals :



(a) 20° (b) 30° (c) 40° (d) 60°

[4] In the figure opposite :

If Δ ABC ≡ Δ DEF,

then the correct statement is :

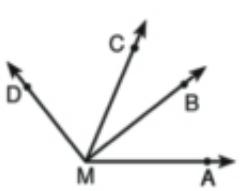
(a) AB = DF (b) BC = DF

(c) AC = DE (d) AC = DF

[5] In the figure opposite :

m (∠ BMD) = 90° , m (∠ BMC) = 50°,

m (∠ AMC) = 70° , then m (∠ AMB) = ...

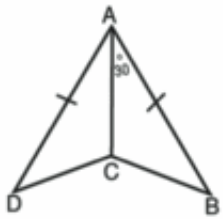


(a) 30° (b) 40°

(c) 70° (d) 110°

3 **[1] Mention two cases of congruency of two triangles.**

[2] In the figure opposite :



If AB = AD , BC = 5 cm , m (∠ B) = 40°

m (∠ BAC) = m (DAC) = 30°

Prove that : First : Δ BAC ≡ Δ DAC

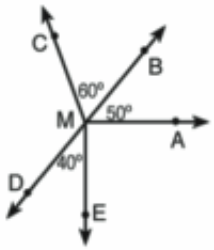
Second : m (∠ D)

Third : the length of $\overline{CD}$

4 **[1]** Using the geometric instruments, Draw $\overline{AB}$ where AB = 6 cm, Draw the axis of symmetry of $\overline{AB}$, take C ∈ the axis of symmetry and of distance 4 cm from $\overline{AB}$.

What is the type of Δ ABC according to its sides ?

[2] In the figure opposite :



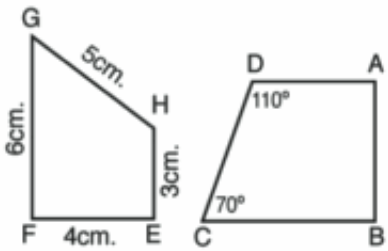
If m (∠ AMB) = 50°,

m (∠ BMC) = 60° , m (∠ DME) = 40° and

$\overrightarrow{AM} \perp \overrightarrow{ME}$,

Find m (∠ CMD)

5 **[1] In the figure opposite :**



the two polygons ABCD, EFGH are congruent

EF = 4 cm, FG = 6 cm,

GH = 5 cm, HE = 3 cm.

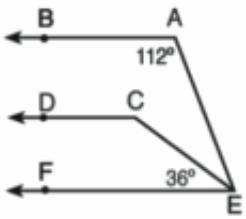
m (∠ C) = 70° , m (∠ D) = 110°,

m (∠ A) = m (∠ B) = 90°

Find : First : the perimeter of the polygon ABCD.

Second : the measure of each angle of the polygon EFGH.

[2] In the figure opposite :



$\overrightarrow{AB}$ // $\overrightarrow{CD}$ // $\overrightarrow{EF}$,

m (∠ EAB) = 112° , m (∠ CEF) = 36°

find : m (∠ AEC), m (∠ C).

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Model (4)

1 Complete the following :

[1] The sum of the measures of the accumulative angles at a point equals .....

[2] If a straight line intersects two parallel straight lines, then :

..... , ... , ...

[3] The axis of symmetry of a line segment is .....

[4] Two polygons are congruent if there is a correspondence between their vertices such that .....

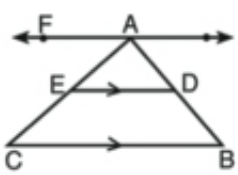
[5] In the figure opposite :

the number of the drawn triangles equals .....

2 *Choose the correct answer from those given :*

[1] In the figure opposite :

AD : AB = ...



(a) 1 : 1 (b) 1 : 2

(c) 1 : 3 (d) 1 : 4

[2] If two straight lines are on the same plane and do not intersect, then they are : .....

(a) skew (b) perpendicular

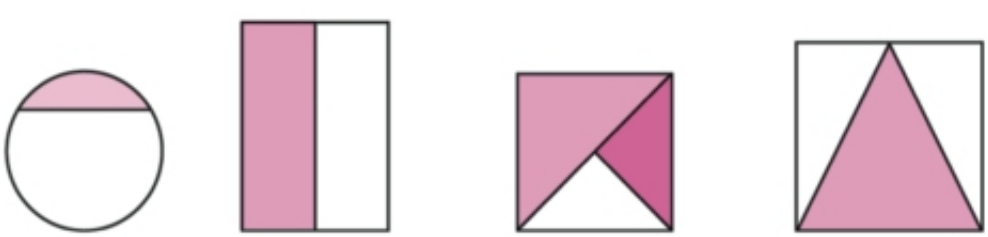
(c) parallel (d) congruent

[3] If ∠ A = ∠ B and A, B are supplementary angles, then m (∠ A) = ...

(a) 45° (b) 90°

(c) 125° (d) 180°

[4] The figure whose shaded region represents $\frac{1}{2}$ its region is .....



(a) (b) (c) (d)

[5] In the following figures : pair of congruent triangles is figure (.....)

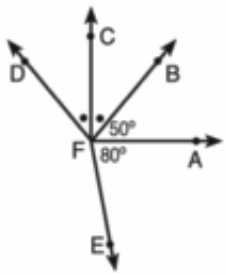
figure (a) figure (b) figure (c) figure (d)

3 **[1] In the figure opposite :**

find m (∠ DFE)

[2] Draw an angle of measure 120°, then divide it into four congruent angles.

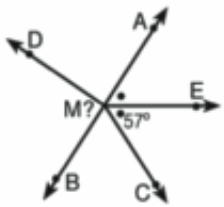
(Don't remove the arcs)



4 **[1] In the figure opposite :**

Calculate m (∠ DMB)

(give reason)

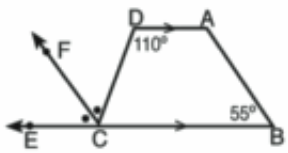


[2] In the figure opposite :

$\overline{AD}$ // $\overrightarrow{BC}$, $\overrightarrow{CF}$ bisects ∠ DCE,

m (∠ ABC) = 55° , m (∠ ADC) = 110°

Prove that : $\overline{AB}$ // $\overrightarrow{CF}$,



5 **[1]** If Δ ABC ≡ Δ DEF, then write pairs of congruent correspondings sides and pairs of congruent corresponding angles.

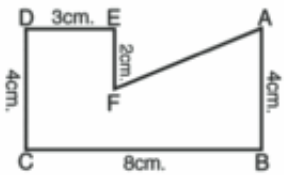
[2] In the figure opposite :

m (∠ B) = m (∠ C) = m (∠ D) = m (∠ E) = 90°

AB = CD = 4 cm, BC = 8 cm

DE = 3 cm , EF = 2 cm.

Find the area of the figure ABCDEF.



Model (5)

1 Complete the following :

[1] Two polygons are congruent if there is a correspondence between their vertices such that .....

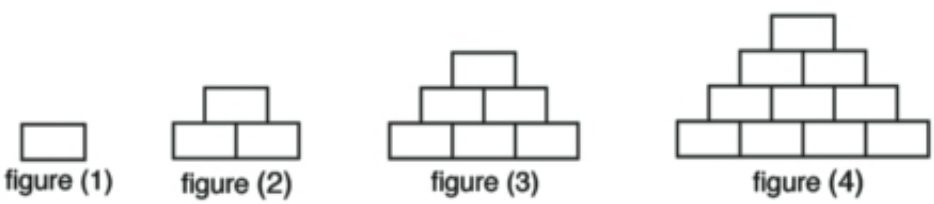
[2] If two straight lines intersect, then each two vertically opposite angles .....

[3] The complement of an angle of measure 65° equals .....°

[4] If m (∠ A) = 155° , then m (reflex ∠ A) equals .....

[5] In the figure opposite :

The number of rectangles formed the 7th figure is .....



2 Complete the correct answer from those given :

[1] The two angles 130° , 50° are .....

(a) complementary (b) supplementary (c) adjacent (d) reflex

[2] The triangle whose perimeter is 12 cm and the lengths of two of its sides are 2 cm, 5 cm is .....

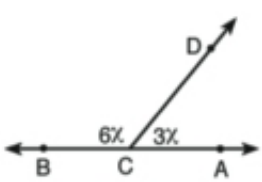
(a) acute (b) right (c) obtuse (d) isosceles

[3] In the figure opposite :

If $\overleftrightarrow{AB} \cap \overrightarrow{CD} = \{C\}$, then X = ...

(a) 20° (b) 30°

(c) 90° (d) 120°



[4] If m (∠ A) = 2 m (∠ B) , ∠ A supplements ∠ B, then m (∠ B) = ...

(a) 30° (b) 60° (c) 90° (d) 120°

[5] Two triangle are congruent if :

(a) the lengths of two corresponding sides are equal.

(b) the measures of the corresponding angles are equal.

(c) the lengths of two corresponding sides and the measure of the included angle are equal.

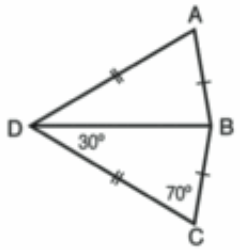
(d) the length of a side and the measure of an angle are equal to the corresponding parts.

3 **[1] Mention two cases of congruency of two triangles.**

[2] In the figure opposite :

AB = BC, AD = CD, m (∠ C) = 70°,

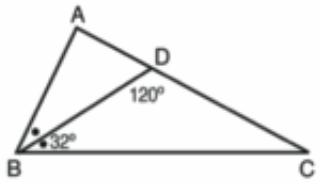
m (∠ BDC) = 30°. find m (∠ ABD).



4 **[1] In the figure opposite :**

$\overrightarrow{BD}$ bisects ∠ ABC, m (∠ CBD) = 32°,

m (∠ BDC) = 120° , find m (∠ A).

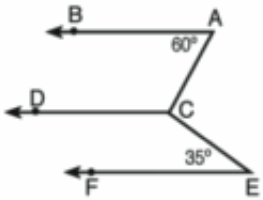


[2] In the figure opposite :

$\overrightarrow{AB}$ // $\overrightarrow{CD}$, $\overrightarrow{AB}$ // $\overrightarrow{EF}$

m (∠ A) = 60° , m (∠ E) = 35°

find m (∠ ACE).



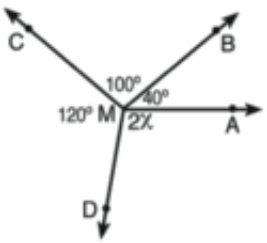
5 **[1]** Draw ∠ ABC where m (∠ B) = 80°, using the ruler and the compasses bisect ∠ B by $\overrightarrow{BD}$. (Don't remove the arcs)

[2] In the figure opposite :

m (∠ AMB) = 40° , m (∠ BMC) = 100°,

m (∠ CMD) = 120° , m (∠ AMD) = 2 X.

find the value of X.



المواصفات الفنيـــة:

مقـــاس الكتـــاب:	$\frac{1}{8}$ (٥٧ × ٨٢) سم
طبـــع الـمتـــن:	٤ لون
طبـــع الغـــلاف:	٤ لون
ورق الـمتـــــن:	٨٠ جم أبيض
ورق الغـــــلاف:	٢٠٠ جم كوشيه
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